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DECISION-MAKING PROCESSES OF  
WEANING FROM MECHANICAL  
VENTILATION

A COMPARATIVE ETHNOGRAPHIC  
INSIGHT INTO THE DYNAMICS OF THE  
DECISION-MAKING ENVIRONMENT

By

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A thesis submitted for the degree of Doctor of Philosophy  
School of Health in Social Science  
Nursing Studies  
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# DECLARATION

I here in declare that this thesis has been composed by me and that the research on which it reports is my own work.

Kalliopi Kydonaki

May 2011

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## **ABSTRACT OF THESIS**

Many critical clinical conditions result in respiratory failure and precipitate the use of mechanical ventilation for their management. A prolonged period of mechanical ventilation is costly for both the patient, in terms of adverse effects, and the health care service. Therefore, immediate liberation of the patient from mechanical ventilation and constitution of spontaneous breathing, a process called weaning, is vital. This daily lifesaving practice, on which nurses are taking an increasing role with the introduction of nurse-led protocols, can become complicated requiring the effective use of assessment information through decision-making processes to improve outcomes of care. Most literature on the field fails to address that weaning decisions are affected not only by the nature of the task but also by the characteristics of the decision-maker and the decision environment. This research aimed to study nurses' decision-making processes when managing the weaning of long-term ventilated patients and to explore the impact of the diverse elements of the clinical environment on this intricate practice.

An ethnographic approach was used to compare weaning decision-making processes in two different culturally intensive care units (ICU). Participant observation was used to follow the weaning practices of 10 patients in a Scottish ICU and 9 patients in a Greek ICU admitted with respiratory failure due to pneumonia or COPD exacerbation. Nurses were observed in their daily weaning practice and participated in reflective interviews at the end of their shift to extrapolate how they used the information to make their decisions. Semi-structured interviews were, then, conducted with nurses, physiotherapists and medical staff to explore their perceptions on weaning practices and the factors that influenced their decisions and clinical practice. Data were analysed thematically and concept maps were developed from the reflective interviews to analyse nurses' decision-making processes.

The concept attainment theory was used as a framework to understand nurses' thinking processes. Nurses in all ranges of experience demonstrated a similar decision-making skill, which signifies that this cognitive process is not always



related to the level of experience and knowledge. Nurses' weaning care was organised around maintaining a balance of care under the 'wean as able' medical instruction. Inconsistency in the weaning decisions led to a variability of weaning approaches followed for each patient and to long periods of weaning inactivity. Various reasons, related to the working relationships, lack of nurses' accountability, lack of support and unstructured information flow, were responsible for the deficiency in sustainable and consistent weaning decisions. In both settings, there was lack of culture to foster a shared decision-making approach in weaning practice and encourage nurses' autonomy in decision-making.

This study concluded with proposing a collaborative decision-making framework for weaning long-term ventilated patients, which will involve and appreciate the contribution of all members of the multidisciplinary team.

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# CHAPTER ONE

## INTRODUCTION

# **CHAPTER ONE**

## **INTRODUCTION**

### **1.0 MOTIVATION FOR THE STUDY**

With the significant evolution of care for critically ill patients and the remarkable technological advances, in the past 40 years, critical care nurses have had to adapt to the increased emphasis on evidence-based health care decisions in clinical practice (Dowding and Thompson, 2003). Moreover, continuous professional development and changes in health care policy have started to recognise the significant impact of nurses' role in decision-making and, consequently, in patient outcome and experience. Hence, nurses' clinical decisions and the processes that underpin them are an integral part of the delivery of health care. It is clinical decisions that commit scarce resources to patients, determine the clinical outcomes associated with care and, in part, shape the health care experience for patients and professionals alike.

An area of clinical practice that has, traditionally, been a physician-led initiative based on judgment and experience, but nursing staff have recently become more closely involved in, is mechanical ventilation and the process of its discontinuation, called weaning. Historically, the aim of nurses' role in mechanical ventilation management has been in monitoring of the patient's breathing function in order to gain an accurate picture of the patient's clinical condition, but not in being responsible for weaning decisions (Norton, 2000; Harris, 2001; Fulbrook, et al, 2004; De, 2004). However, the introduction of weaning protocols has offered an opportunity for instituting an advanced nursing role in weaning practice, allowing the use of nurses' clinical judgment in weaning decision-making (Crocker, 2002).

The diversity of clinical conditions and their pathophysiology, as well as the variability and individuality of each patient's response to mechanical ventilation and weaning necessitates the use of advanced knowledge and skills in providing an accurate picture of the patient's current condition and detecting changes continuously

of the patient's response. Critical care nurses are in the privileged position to gain this information and instigate significant decisions about the patient's weaning management. The question that originates, though, is whether this increasing role of nurses in weaning management, facilitated with the introduction of weaning protocols, is interpreted in actually making independent clinical decisions and taking responsibility for them.

The literature reveals a lack of research on nurses' role in protocol and non-protocol weaning, whereas Harris (2001) notes that identifying nurses' role in weaning practices is difficult in the United Kingdom (UK) due to the wide heterogeneity of Intensive Care Units (ICU) and their variability in their weaning practices. Similarly, in Greece and other European countries data on nurses' role are indicative of great variation regarding performance of specific nursing tasks, such as weaning (Plati, et al., 1996; Heering, 1996; Monaco and Bruziches-Bruziches, 1999).

My professional experience as a critical care nurse, in two different countries, and, consequently different ICU environments, for the last eight years, generated an enquiry about the nature of nurses' involvement in decision-making during the weaning process from mechanical ventilation, given the establishment of protocolized weaning. As a graduate of Nursing Studies from the University of Athens in Greece, I was first employed in a large health care institution. Being interested in critical care, I was appointed as a staff nurse in critical care. During my first working experience I was exposed to a biomedical model of care, where nurses' involvement was limited to the monitoring of the patient's condition, drug administration and basic care of the critically ill body. Recently enacted Greek legislation decreed medical directors as accountable for all care provided in ICU, including nursing care (Papathanassoglou, et al., 2005). Therefore, management of mechanical ventilation and weaning was exclusively a medical duty and nurses were not encouraged to be involved in, apart from when carrying out medical instructions. This restricted nursing role in patient management, and particularly mechanical

ventilation and weaning, was so well embodied in the culture of the Greek ICU that it was rarely questioned by nursing staff and nurse leaders.

Coming to Scotland for my postgraduate studies, seven years ago, I had the opportunity to be employed as a staff nurse in a general ICU. My working experience in the Scottish clinical environment created bewilderment about nurses' involvement in clinical decisions and their role within the multidisciplinary team. I found myself being more involved in decisions about the patient's weaning from mechanical ventilation and felt encouraged to use my clinical judgment as I was becoming more competent and more integrated in the Scottish ICU.

I started questioning my existing hunches on the passive role of the critical care nurse during mechanical ventilation and weaning management as nourished within the Greek biomedical model of care. My personal belief that critical care nurses are able and should have a more active role in weaning decision-making was the driver for conducting this study. This personal belief, though, created a risk of imposing my own ideas rather than the reality, which I needed to challenge with an auto-ethnographic study, as presented in chapter five, so as to understand my role in the study.

Adding to the factors that motivated this study, my personal observation of weaning practices revealed variability of clinical behaviour during weaning from mechanical ventilation. This variability was expected in the Greek ICU where there is a lack of an implemented weaning protocol, but it came as a surprise in the Scottish ICU, where the existing protocol aimed to standardize weaning care. This difference generated the need for further exploration of the role of weaning protocols in facilitating the weaning process and guiding decision-making and nurses' input. In my experience, I recognised that nurses do not act in isolation, but rather are members of a multidisciplinary team; therefore, their clinical behaviour is influenced by elements of the working environment. These preliminary thoughts prompted the need to investigate the factors that influence nurses' clinical behaviour during the weaning process from mechanical ventilation.

My professional background and interest in mechanical ventilation and weaning process instigated the idea of conducting a comparative study between my country of origin, Greece, and my country of current residency and practice, Scotland. Identifying how critical care nurses make decisions within their clinical environment will enhance our understanding about their role in responding to increasingly complex and acute patient problems.

## **1.1 THE IMPORTANCE OF STUDYING MECHANICAL VENTILATION AND WEANING**

Medical conditions that cause pulmonary dysfunction (asthma, emphysema, chronic obstructive pulmonary disease, pneumonia, cystic fibrosis), cardiovascular dysfunction (pulmonary oedema, cerebrovascular accident, congestive heart failure), lack of neuromuscular ability to breathe (neurological diseases) or lack of respiratory drive (drug intoxication) can result in respiratory failure, which is the respiratory system's inefficiency to provide adequate gas flow and secure gas exchange in the lung parenchyma. These conditions can be life threatening. When the human is not able to do the work of breathing, mechanical ventilatory support is used as a treatment in critical care environments and substitutes the breathing function by generating a controlled flow of gas into the patient's airways.

The innovation to use positive pressure to ventilate a patient provided a novelty in the management of life-threatening conditions. Technological growth resulted in a plethora of models of mechanical ventilation that addressed the needs of patients with acute or chronic respiratory conditions. Whilst positive pressure mechanical ventilation is a life-saving medical intervention during acute or chronic diseases causing respiratory failure, it results in a number of physiological changes and adverse effects of the respiratory, cardiovascular and other body systems. These changes relate to altered respiratory mechanics that influence the physiology and homeostasis of the critically ill body and are briefly explained in chapter two, so as to help the reader understand the context and complexity of the decisions when managing the patients' ventilation.

As the clinical conditions that warranted placing the patient on the ventilator stabilize, attention should be placed on removing the ventilatory support as quickly as possible. The process of removing the patient from mechanical ventilation is called ventilatory weaning. The aim of the ventilation weaning process is to enable the patient to assume a greater ventilatory workload by reducing the support given from the ventilator (Hess, 2001, 2002). Depending on the patient's response this

course of action can occur rapidly or it can require a prolonged process until establishment of spontaneous breathing. Constant monitoring of the patient can instigate the appropriate decisions to continue with reductions of ventilatory support until complete liberation.

Unnecessary delays in the weaning process result in respiratory muscle weakness caused by deconditioning and disrupted regulation (Pierce, 1995) and increase the risk of complications, such as airway trauma, discomfort, additional sedation and neuromuscular blockage requirements, ventilator associated lung injury and Ventilator Associated Pneumonia (VAP) (Burns, Ryan and Burns, 2000; Hughes, et al., 2001; MacIntyre, 2001, 2004), as well as frustration for the patient, the family and the clinicians (Burns, et al., 1994). On the other hand, an aggressive approach to weaning can result in premature removal of the ventilator and consequent cardiorespiratory compromise, difficulty in re-establishing the artificial airway, nosocomial pneumonia, ventilatory muscle fatigue and increased mortality (Ely, et al., 2001; MacIntyre, 2004). Prompt recognition of the time and appropriate method for withdrawal of mechanical ventilation has been shown to reduce the risk of adverse effects and increase the likelihood of early recovery (Esteban, et al., 1997; Dries, et al., 2004; MacIntyre, 2004).

It has been estimated that approximately 40% of the time spent on the ventilator is during the weaning phase, whereas this percentage increases to approximately 60% for patients who have a chronic lung disease, such as Chronic Obstructive Pulmonary Disease (COPD) (Manthous, 2000; Keenan, 2002; Keenan, et al., 2003). Weaning procedures are unsuccessful in 20% of the cases, whereas for the COPD patients this percentage increases to 50% for the first weaning attempt (Matić, et al., 2007). Unsuccessful weaning for COPD patients is predictive of poor outcome, including mortality (Yang and Tobin, 1991). Because of the increased morbidity and high cost associated with prolonged mechanical ventilation and, consequently, prolonged stay in intensive care, weaning from mechanical ventilation is designated as a research priority for several international agencies, such as The National Health Service



Modernization Agency in the UK (National Health Service Modernization Agency, 2002) and the Agency of Health Care Policy and Research in the United States (MacIntyre, 2004; Rose and Nelson, 2006).

The complexity of weaning from mechanical ventilation requires the intensive use of clinical judgment and advanced decision-making skills. Critical care nurses have a pivotal role in the management of mechanical ventilation and weaning, since they have been described as the around-the-clock surveillance system (Aiken, et al., 2003) and are in an excellent position to assess physiological and psychological indicators of the patient's readiness or failure to wean and interpret the patient's pathophysiological changes. Bedside nurses are required to decide what data to collect, to interpret the information, plan and administer interventions and finally to evaluate patient outcomes while reducing ventilatory support. Understanding how nurses use this knowledge to inform their clinical decisions and judgments is comparatively sparse, but of prime importance since nurses' increasing role in mechanical ventilation and weaning decisions has more potential than ever to impact on patients' lives and outcome. This study aims to address this purpose.

## **1.2 USE OF TERMINOLOGY**

Before embarking on the description of the study, it is important to clarify key terms that are used throughout the thesis. The word mechanical ventilation describes the constitution of artificial breathing with the use of machinery, called a ventilator, which substitutes the patient's spontaneous breathing. The process of withdrawing mechanical ventilation is called weaning. More information about the weaning process and its stages is provided in the review of the literature in chapter two. Respiratory failure (RF) is used to describe a clinical condition, which constitutes the inability of the patient's respiratory system to provide adequate gas flow and gas exchange in the lungs to meet physiological demands (Tobin, 1994).

The term intubation is used to indicate the insertion of an endotracheal tube in the patient's trachea in order to institute mechanical ventilation. Re-intubation is the term used to signify re-insertion of an endotracheal tube after a failed extubation. The term extubation means removal of the endotracheal tube and establishment of spontaneous breathing. The term tracheostomy signifies the incision and formation of a stoma in the patient's trachea and insertion of a tracheal tube, shorter than the endotracheal tube. Other technical and clinical terms are provided in the Glossary, to which the reader can refer.

### **1.3 STRUCTURE OF THE THESIS**

This thesis is unavoidably written in a linear fashion which cannot adequately reflect the process by which I developed an understanding of the research questions. In particular, my understanding of the theory of the social construction of reality developed in parallel with my experiences of and reflections on my fieldwork. Following this introduction, chapters two and three introduce the literature that was used as a background to conduct this study. Chapter two critically appraises the relevant and most recent studies on weaning from mechanical ventilation, focusing also on the role of nurse-led protocols. Chapter three presents the several perspectives for investigating decision-making practices and theories that examine either the outcomes and results of decision-making processes or the actual decision-making process. The focus is on the use of the concept attainment theory, as a framework to study nurses' decision-making processes in the real setting (Bruner, Goodnow and Austin, 1956).

Chapter four outlines the research methodology used for this study. My personal account on decision-making during weaning is examined in an auto-ethnographic exercise that was conducted prior to the main data collection and is presented in chapter five. Chapters six, seven and eight present the findings of the study. Chapter six discusses the decision-making approaches followed by nurses, chapter seven demonstrates their clinical behaviour centring on the two main themes identified, 'wean as able' and 'maintain a balance'. Chapter eight focuses on the elements of the working environment that influenced nurses' clinical behaviour.

The findings of the study and reflexive notes on the research process are discussed in chapter nine providing also recommendations for further research, education and practice. Finally, chapter ten summarises the main points and implications of the study.

## CHAPTER TWO

# VENTILATION WEANING PROCESS: PATHOPHYSIOLOGY AND MANAGEMENT

# **CHAPTER TWO**

## **VENTILATION WEANING PROCESS: PATHOPHYSIOLOGY AND MANAGEMENT**

### **2.0 INTRODUCTION**

Mechanical ventilation is a life-saving technological intervention for patients whose respiratory function is compromised due to an acute or chronic disease. Despite its positive influence, it can cause various adverse effects since it bypasses and deactivates the physiological structure and function of the upper airways (mouth, glottis, and trachea) with the introduction of the endotracheal tube. This chapter starts with a brief explanation of these adverse effects in order to illustrate their significance during the process of ventilatory support and its discontinuation.

The chapter continues with describing the clinical problem and the importance of weaning and critiques the relevant studies on identifying the patients' readiness to initiate the process of weaning and selecting the appropriate approach to reduce the ventilatory support. Consideration is given to the literature on the management of the difficult-to-wean patient. The role of the protocols is analysed in various studies that explore their effectiveness on patient outcome.

A search of various databases was required to extract the most recent written material on the weaning process. The electronic databases Database of Abstracts of Reviews of Effects (DARE), the Cochrane Database of Systematic Reviews (CDSR), MEDLINE, EMBASE, CINAHL were searched from 1995 to 2010. The database LILACS was also searched for articles in Latin languages so as to reduce the bias of language. The National Institute for Health and Clinical Excellence (NICE) and the Scottish Intercollegiate Guidelines Network (SIGN) guidelines were searched, but did not reveal any related papers.

To avoid publication bias, reference lists, conference abstracts and reports were explored from the European Society of Intensive Care Medicine (ESICM) conference, the World Federation of Critical Care Nurses (WfCCNa) and European Federation of Critical Care Nurses (EfCCNa) conferences that took place between 2007 and 2010. To minimise bias and errors in the study selection process, two high impact factor journals of critical care were hand-searched from 2008 to 2010; the Intensive Care Medicine and the Respiratory Care.

The most frequent key words used for searching were ventilatory weaning, mechanical ventilation, artificial breathing, weaning criteria, weaning methods, weaning protocol, protocolized weaning, nursing, nurse-led weaning and weaning outcomes. The key words were combined using the Boolean logic, using truncation and wildcard characters. Studies conducted in any country and reported in any language were eligible for selection. Those papers were then limited to full text and to English and Greek language. A total of 130 papers were examined for the literature review.

## **2.1 CONCEPTUALISATION OF MECHANICAL VENTILATION**

### **2.1.1 THE NEED FOR MECHANICAL VENTILATION**

In humans, respiration is the transport of oxygen from the air to the cells within the tissues and the transport of carbon dioxide to the air. This function is enabled with the respiratory system, which includes airways, lungs and the respiratory muscles, and works in concert with the cardiovascular system to carry gases to and from the tissues. The molecules of oxygen and carbon dioxide are passively exchanged, by diffusion, between the gaseous external environment and the blood. This gas exchange process occurs in the alveolar region of the lungs.

During normal breathing, air is drawn into the lungs with expansion of the chest wall and contraction of the diaphragm, creating negative pressure into the thoracic cavity relative to the atmospheric pressure. Hence, in normal breathing air flow into the lungs is generated because of the negative pressure. Conventionally, inspiration is active and expiration is passive. The respiratory muscles, normally, function only during inspiration in order to move the ambient air into the alveoli of the lungs, and remain passive during expiration. The diaphragm is the most important muscle of respiration but the intercostal muscles can also generate energy during heavy breathing (Hill and Levy, 2001).

The pressure required to produce a flow of gas of 1 litre through the airways is called airway resistance and for a normal adult when breathing spontaneously, it is 2cmH<sub>2</sub>O (Hinchliff and Montague, 1989, p. 484). Any increase in exercise increases the airway resistance resulting in work of breathing 50 times greater than normal (Morley, 1993).

The institution of mechanical ventilation via an endotracheal tube precipitated from the presence of a diseased lung alternates these physiological structures. Firstly, a ventilated patient, who is unable to breathe due to a diseased lung, has to overcome the airway resistance, which increases when the diameter of the airways is narrowed, such as in the case of secretions, oedema or bronchospasm. Introduction of forced

positive pressure into the lungs from the ventilator minimises the negative pressure that generates the gas flow normally and deactivates inspiration making the inspiratory muscles passive. Consequently, inspiration becomes a passive movement and expiration an active function. This means that the patient needs to generate energy to exhale using the respiratory muscles (Tobin, 1994).

In this functional change of the respiratory mechanics is added the resistance in breathing caused by the mechanical structure of the ventilator. The airway resistance increases by 200% with intubation and mechanical ventilation, because the physiological structure and function of the upper airways (mouth, glottis and trachea) are bypassed and deactivated (Gal and Suratt, 1980). The endotracheal tube also increases the airway resistance due to stimulation of the vagal nerve causing constriction of the bronchi. Davis, et al. (1994) showed that the resistance is less with shorter and more rigid tubes, such as the tracheostomy tubes, which explains their use in long-term ventilated patients who fail to disconnect from the ventilator.

Modern ventilators have active exhalation valves, which are designed to open quickly once the patient starts to exhale, permitting the gas flow and preventing re-breathing; therefore, the patient not only has to generate energy to exhale but also to overcome the resistance of opening the exhalation valve of the ventilator.

With the development of more technologically sophisticated ventilators in the past ten years, clinicians can manipulate the settings of the ventilator to achieve the best oxygenation for the patient with less effort. These settings refer to selecting the appropriate mode of ventilation depending on the ability of the patient to participate or not in the breathing process, the amount of oxygen, the volume of air inspired and the frequency of breaths as well as the amount of positive pressure delivered from the ventilator. This positive pressure is presented in two main forms: the Positive End Expiratory Pressure (PEEP), which is the pressure required to be delivered so that the alveoli do not collapse at the end of expiration; and the positive pressure support (PS) delivered on top of the PEEP, so that the patient receives adequate volume of air. Deciding on the best manner to manipulate the ventilatory settings



requires advanced knowledge and skills so as to avoid the potential adverse effects of positive pressure ventilation.

#### 2.1.2 ADVERSE EFFECTS OF MECHANICAL VENTILATION

With the implementation of positive pressure mechanical ventilation, some of the mechanics of the respiratory system change. The most significant changes are the decrease of the lung compliance, the increase of the alveolar dead space, the ventilation-perfusion ratio (V/Q) mismatch, and the increased intrinsic Positive End Expiratory Pressure (PEEPi). Other effects of positive pressure ventilation are barotrauma, oxygen toxicity, respiratory alkalosis and increased intrathoracic pressure (Tobin, 1994). These mechanics play a significant role during mechanical ventilation and its discontinuation process and are briefly explained below.

##### 2.1.2.1 Decreased lung compliance

Compliance is the ability of the lungs and the chest wall to expand and become elastic when pressures generate in the lungs during breathing. In normal conditions, lungs are very compliant (Hinchliff and Montague, 1989). However, in diseased lungs, the compliance is altered. Increased compliance can result from overstretching and destruction of alveoli from lung disease, such as emphysema or COPD or ageing and is due to loss of elasticity and increased rigidity of the thoracic cage. Decreased compliance results in limited lung expansion causing stiff lungs (Tobin, 1994). It has been shown that mechanical ventilation with increased positive pressures delivered reduces lung compliance because of a reduction in the production of a lipoprotein (surfactant) in the alveoli (Tobin, 1994). Therefore, the lungs become more rigid and stiff and have reduced expandability. This increases the work of breathing to force air out of the lungs during expiration. As a result, these patients feel air hunger and increase the velocity of inspiration (faster respiratory rate) in order to get air into their lungs.

#### 2.1.2.2 Increased alveolar dead space

Physiologically, the volume of air that enters the lungs per minute and participates in gas exchange between the capillaries and the alveoli is called alveolar ventilation. The alveolar ventilation depends on the surface of the alveoli that participate in the exchange of oxygen and carbon dioxide (gas exchange). However, some volume of air does not participate in the gas exchange and is called dead space (Tobin, 1994). The dead space is divided into the anatomical dead space, which is the air in the conducting airways (mouth, larynx, trachea and bronchi) that does not come into contact with the alveoli (approximately 150ml), and the alveolar dead space, which is produced when the alveoli are over-ventilated relative to their perfusion. This excessive ventilation does not participate in gas exchange and is wasted.

In healthy humans, the alveolar dead space is negligible, but in diseased lungs it increases due to the pathological changes caused to the alveoli from over-distension. Collapse of areas of lung tissue (alveoli), which is called atelectasis (Mosby's Medical and Nursing Dictionary, 1983), and presence of secretions can result in increased dead space. Mechanical ventilation can cause increased dead space when increased volumes of air are delivered in high positive pressure. This causes further over-distension of the alveoli and inhibition of capillaries perfusion. With positive pressure ventilation, the air is delivered to the central alveoli first and then to the peripheral, which is reversed from the physiological gas distribution in the lungs in spontaneous breathing.

#### 2.1.2.3 Changes of ventilation–perfusion (V/Q) ratio

To have adequate gas exchange in the lungs, sufficient air and blood must be delivered to the alveoli each minute in the right proportions. The ratio of alveolar ventilation to pulmonary capillary blood flow or perfusion (V/Q ratio) is very important for adequate gas exchange and is related to the patient's positioning. In a normal upright position, both alveolar ventilation and perfusion increase because the gas flows from apex to the base due to gravity (Kreit and Eschenbacher, 1988).

However, inequalities of the V/Q ratio occur in the presence of lung disease, in which a mismatched distribution of ventilation and perfusion in some lung units occurs, diminishing the gas exchange and increasing the work of breathing (Kreit and Eschenbacher, 1988).

In conditions that result in reduced blood perfusion (flow) from the pulmonary artery, such as in cardiogenic shock, haemorrhage or due to positive pressure ventilation, the areas of the capillaries are not perfused efficiently, but are ventilated adequately. This results in high V/Q ratio and increase of the alveolar dead space.

In the case of obstructed, damaged or collapsed areas of alveoli, such as in COPD, pneumonia, emphysema, the air that flows to the alveoli is not used, although there is adequate perfusion from the pulmonary capillaries. The low V/Q ratio causes reduced oxygenation of the arterial blood (hypoxia), which can be accompanied by increased levels of carbon dioxide in the arterial blood (hypercapnia) and increased work of breathing. Moreover, raised level of positive pressure applied from the ventilator can cause V/Q mismatch, because it decreases the volume of air that remains in the alveoli at the end of expiration (or else Functional Residual Capacity) and prevents them from collapsing.

#### 2.1.2.4 Increased intrinsic PEEP

In patients with obstructed airways or decreased elastic recoil, the expiration phase is prolonged and not completed before ensuing inspiration, which implies that there is still positive pressure in the alveoli. Once the air is in the alveoli, it has difficulty leaving during the expiratory phase, and consequently, gas is trapped inside the alveoli causing gradual distension of the alveoli and consequent loss of their elasticity resulting in over-distension.

The pressure caused by the gas trapped in the alveoli is called Auto-Positive End Expiratory Pressure (auto-PEEP) or intrinsic PEEP (PEEP<sub>i</sub>). Consequently, the patient has to develop an equal to PEEP<sub>i</sub> amount of pressure to initiate airflow in the next inspiration. Because of muscle weakness, the patient is not neuromuscularly

competent to sustain this increased load. Selection of the adequate level of PEEP (usually less than 85% of the level of PEEPi) delivered from the ventilator aims to help the patient overcome the intrinsic pressure to generate airflow (Sydow, et al., 1995; MacIntyre, et al., 1997). Careful adjustment of the PEEP level is required to prevent further life-threatening complications for the patient, such as pneumothorax.

#### 2.1.2.5 Barotrauma

When high positive pressures are delivered from the ventilator, they can cause over-distension and rupture of the alveoli (barotrauma), causing air to dissect centrally along the peri-vascular sheaths (MacIntyre, 1993). A severe consequence of barotrauma is tension pneumothorax, which is a life-threatening condition, caused by air trapped within the hemithorax that cannot escape (MacIntyre, 1993).

#### 2.1.2.6 Oxygen toxicity

Oxygen toxicity is a major effect of mechanical ventilation and is induced usually by high levels of oxygen ( $FiO_2$ ) delivered by the ventilator. It can cause extra-pulmonary effects (suppression of erythropoiesis, depression of cardiac output and systemic vasoconstriction) or pulmonary effects (depression of pulmonary ventilation, vasodilation of the pulmonary vasculature, and reduced formation of surfactant and consequent collapse of the alveoli) (Hinchliff and Montague, 1989).

#### 2.1.2.7 Respiratory alkalosis

Another problem of positive pressure mechanical ventilation occurs when the respiratory rate and the volume of air delivered in the lungs in each breath (tidal volume,  $V_t$ ) are set too high, therefore, causing over-distension of the alveoli. In such case, the patient blows off too much carbon dioxide causing a reduction of its level in the arterial blood (hypocapnia) and a rise in blood pH. This is called respiratory alkalosis and can be dangerous for patients with cardiac problems, as it causes reduction of the potassium level in the blood, cardiac dysrhythmias, decrease of the cardiac output, cerebral vasoconstriction, and increase of the haemoglobin affinity

for oxygen reducing oxygenation (Hinchliff and Montague, 1989). According to Pierson (1990), the moderate hypocapnia produced is frequently the reason for prolonged weaning.

#### 2.1.2.8 Raised intrathoracic pressure

The forced positive pressure counteracts the effects of the opposing forces produced by the elastic recoil of the lungs and chest wall resulting in increased intrathoracic pressure during inspiration. This increased pressure has adverse effects on the cardiac function, such as low venous return and cardiac output, low renal and hepatic perfusion (Kreit and Eschenbacher, 1988). Increased intrathoracic pressure reduces the extrathoracic-intrathoracic pressure gradient decreasing the venous return. It also prevents the 'sucking force' during inspiration, and reduces the abdominal-thoracic pressure gradient. Moreover, the positive pressure distends the alveoli and stretches the pulmonary capillaries, causing resistance to the outflow of blood from the right ventricle; thus causing further reduction of the systemic blood pressure (Kreit and Eschenbacher, 1988).

#### 2.1.2.9 Effects of sedation

A key feature in the management of mechanical ventilation, and consequently its discontinuation, is the use of sedation and analgesia. For a patient to tolerate the introduction of an endotracheal tube, in order to institute mechanical ventilation and allow the body to cope with the diseased lung, there is the need to use sedative drugs, which depress the conscious level and respiratory drive of the patient. Sedation management is known to influence the duration of mechanical ventilation (Kress, et al., 2000). Recent evidence from clinical trials evaluating sedation protocols (Brook, et al., 1999), daily interruptions of sedatives (Kress, et al., 2000) and intermittent use of sedatives (Carson, et al, 2006) have reported reductions in the duration of mechanical ventilation and ICU stay.

## **2.2 THE CONCEPT OF WEANING FROM MECHANICAL VENTILATION**

Prolonged mechanical ventilation is associated with adverse clinical outcomes, including physiological and psychological experiences. In the current climate of limited ICU bed availability, maximising use of limited ICU resources (nurses and equipment costs) is an important goal of providing care to critically ill patients (Blackwood, et al., 2010). Thus, timely and safe discontinuation of mechanical ventilation is a desirable outcome for patients and clinicians alike.

The process leading to discontinuation of mechanical ventilation is known as weaning. According to Mancebo (1996), weaning is defined as ‘the period of transition from the full ventilatory support to spontaneous breathing’ (National Health Service Modernisation Agency, 2003, p.6). The word weaning usually implies a gradual withdrawal from a nurturing life support system (Mancebo, 1996), whereas other authors prefer the more encompassing term discontinuation (MacIntyre, 2001) or liberation from mechanical ventilation, as this signifies the release from a restrictive, potentially dangerous process (Kollef, et al., 1997).

However, the interpretation of the transition to spontaneous breathing varies. This process can range from abrupt to gradual withdrawal from ventilatory support and can have various stages. There are different schools of thought regarding this gradual process of weaning. Some clinicians support that the transition should be initiated gradually from the onset of mechanical ventilation transferring the breathing workload to the patient as tolerated (Knebel, et al., 1994). Others believe that this transition should be made once the clinical condition that precipitated the introduction of mechanical ventilation is significantly resolved or when early signs of improvement present (Marini, 1995).

Pioneers in the area of weaning were The Third National Study Group on Weaning in the USA, who, sponsored by the American Association of Critical Care Nurses (AACN), proposed a model of weaning to provide an organising framework for the

discussion and study of issues related to discontinuing from mechanical ventilation (Knebel, et al., 1994). In 1998, the same study group refined this model and this concluded in its final form, the Weaning Continuum Model (Knebel, et al., 1998). This conceptual model consists of three weaning stages; the pre-weaning stage, the weaning stage and the outcome stage. These stages of weaning, as described by the above study group, are also supported in a study by Curley and Fackler (1998) conducted on young children, who portrayed the weaning continuum as peaks and valleys rather than a linear predictable pattern.

According to the Weaning Continuum, there are three distinct time points. The first stage, the pre-weaning stage, refers to the period when active weaning cannot occur, because the event that precipitated the mechanical ventilation is not resolved and attempts are made to prevent complications that may interfere with weaning. Decisions made during the pre-weaning stage include the readiness of the patient to start weaning, the mode of weaning to use and the approach to the process. The refined weaning continuum model includes a readiness threshold in the pre-weaning stage, which marks the transition from the pre-weaning stage to the weaning stage and reflects the physiological stability of the patient. If the patient's physiological status deteriorates below the readiness threshold, weaning ceases and the pre-weaning stage is re-entered.

The second phase, the weaning stage, is defined as the interval when the patient's condition is stable and the patient is able to sustain reduction of ventilatory support. Decisions made during this stage involve screening the ability of the patient to breathe spontaneously, identifying the appropriate mode of ventilation for weaning and the approach followed. Other decisions involve interventions that facilitate the weaning process, such as tracheostomy formation and intensive physiotherapy. Deciding when to initiate weaning and the best ventilatory mode to use in weaning is an inexact science, since most studies on techniques to wean provide conflicting results and the published reviews of different modes of weaning focus on the impact of these modes on the work of breathing rather than the time to wean (Butler, et al.,

1999). Therefore, former practice worldwide was always based on clinicians' preference (Ely, et al., 2001).

The final stage of the weaning continuum is the weaning outcome, which consists of spontaneous breathing with or without an artificial airway for more than 24 hours, or incomplete weaning with dependence on partial ventilatory support or death (Knebel, et al., 1994). Decisions made during this stage refer to disconnecting the patient entirely from the ventilator, which is called extubation. For the patients who sustained a tracheostomy formation to facilitate their weaning, the outcome of successful weaning is the disconnection from any positive pressure ventilatory support or decannulation of the tracheostomy tube.

Although the Weaning Continuum, as proposed by the Third National Study Group on Weaning, is only one theoretical possibility and requires further testing with larger, robust studies, the literature search did not reveal any other framework that could best explain the weaning trajectory, and therefore, be used for this study. Hence, selecting this model as a framework to describe the weaning process for this study seemed appropriate.

Burns, Ryan and Burns (2000) in a prospective cohort study tested this model by using the Acute Physiology and Chronic Health Evaluation III score (APACHE III, APACHE Medical Systems, McLean VA) (Knaus, et al., 1991), the Therapeutic Intervention Scoring System (TISS) (Cullen, et al., 1974; Keene and Cullen, 1983), the Burns Wean Assessment Program (BWAP) (Burns, et al., 1991) and the Weaning Index (WI) (Jabour, et al., 1991). Adding to the concept of weaning, the authors identified a clear distinction of the acute stage separate from the pre-weaning stage, and claimed that the trajectory and length of the acute stage may be important predictors of outcomes of the long-term ventilated patients.

Since long-term ventilation was identified by the Third National Study Group on Weaning as the continuation of mechanical support beyond three days, Burns, Ryan and Burns (2000) supported that the introduction of the acute stage of weaning, may



help define the interval that separates short-term and long-term ventilation. The acute stage is characterised by medical instability in the patients' condition for 48 to 72 hours, the need for diagnostic and therapeutic interventions and difficulty to attain weaning assessment due to the increased level of sedative and muscle relaxant drugs infused to the patient to ensure adequate ventilation (Burns, Ryan and Burns, 2000).

Decisions during the weaning process should focus on identifying the readiness of the patient to initiate weaning, the selection of the appropriate approach to wean and on identifying the ability of the patient to breathe without the help of a ventilator. The significance of these decisions lies on recent work, which showed marked atrophy of the diaphragmatic muscle after less than three days of ventilation, stressing the need for selecting the appropriate approaches to reduce ventilatory support for the patients who fail to liberate from the ventilator within 24 hours (Levine, et al., 2008). Various factors can cause dependence of the patient on the ventilator and necessitate a gradual approach to transferring the breathing workload to the patient by titrating the ventilatory support according to the patient's needs. These factors are discussed below.

#### 2.2.1 VENTILATOR DEPENDENCE AND FACTORS THAT CAUSE IT

Eighty per cent of patients who receive mechanical ventilation in intensive care are able to resume spontaneous breathing and be disconnected from the ventilator (Esteban, et al., 1995). The remaining 20% experience prolonged discontinuation from mechanical ventilation. The term 'ventilatory dependence' is used for those patients who have difficulty in discontinuing mechanical ventilation beyond 24 hours and have failed any attempts to be disconnected from the ventilator (Tomlinson, et al., 1989; Esen, et al., 1992; Brochard, et al., 1994; Esteban, et al., 1995, 1997). These patients have been described as difficult-to-wean from the ventilator (Butler, et al., 1999).

Alia and Esteban (2000) highlighted that the incapacity of the respiratory muscle to cope with the breathing load can lead to weaning failure. Recent observational prospective studies of prolonged ventilated patients have determined acquired neuromuscular disorders to be common in ICU patients and result in ICU-acquired weakness (Schweickert and Hall, 2007). These studies have linked these disorders (polyneuropathy and myopathy) to the prolonged weaning time and difficulty in weaning. Mainly prospective cohort studies have identified risk factors for the incidence of critical illness polyneuropathy (CIP) and critical illness myopathy (CIM). The Systemic Inflammatory Response Syndrome (SIRS), sepsis and Multi-Organ Failure have been shown to have a key role in the development of neuromuscular disorder and weakness (Zochodne, et al., 1987; Witt, et al., 1991; Bolton, 1993, 1996, 2005). Other factors are the severity of illness (de Letter, 2001; Bednarik, 2005), hyperglycaemia (Witt, et al., 1991; Van den Berghe, et al., 2005), immobility (De Jonghe, et al., 2002) and use of corticosteroids and neuromuscular blocking agents (NMBAs) (de Letter, 2001; Van den Berghe, et al., 2005), which have been shown to have a relation but have not been identified as independent risk factors.

There is a number of reasons why a patient is dependent on the ventilator, which relate to neurological issues and muscle weakness, respiratory mechanics and imposed load of breathing, metabolic factors, gas exchange factors, cardiovascular factors and psychological factors (MacIntyre, 2009) (Table 2.1). MacIntyre (2009), in his paper on the evidence-based practice for weaning, recommended that identifying the reason that contributes to ventilator dependence and reversing this before attempting any further efforts of weaning, should be an integral part of ventilatory weaning.



overcome in order to initiate another breath. Eventually, the alveoli lose their elasticity and are unable to participate in gas exchange.

Moreover, full mechanical ventilatory support and immobilisation of critically ill patients lead to atrophy of the skeletal muscles and consequently of the diaphragm (Vassilakopoulos, Zakynthinos and Roussos, 1998). Therefore, those patients are prone to respiratory muscle fatigue and require rest between the spontaneous breathing trials to recover. It has been shown that 24 hours are needed for recovery from respiratory muscle fatigue (Laghi, et al., 1995). Vassilakopoulos, Zakynthinos and Roussos (1998) highlighted that inability of a patient to wean is multifactorial and a balance between the ventilatory needs and the neuro-cardio-respiratory capacity is required to achieve weaning success.

Identifying the readiness of the patient to sustain the breathing load, while reducing ventilatory support, requires monitoring and thorough assessment by the bedside nurse. The literature is rife with studies on weaning predictors and indexes that assist in decisions to wean ventilatory support. These studies are presented in the following section.

## **2.3 STUDIES ON PREDICTORS OR CRITERIA USED BY CLINICIANS TO MAKE DECISIONS DURING THE WEANING PROCESS**

Studies on predictors of the patient's ability to wean from mechanical ventilation date from the last forty years and support that the process of discontinuing mechanical ventilation begins with the recognition of adequate recovery from the acute onset of respiratory failure that imposed the invasive ventilation (MacIntyre, 2009). These studies have focused on identifying the best criteria to assess the patient's readiness to initiate the weaning process and the predictors of the weaning outcome that could guide clinicians' decisions. Evidence comes mostly from a few randomised controlled trials (RCTs) and observational studies that compared certain parameters in a group of patients who were successfully weaned and a group of patients who were unsuccessful in weaning with the aim to find those predictors.

The most recent systematic reviews on weaning predictors were conducted by the Agency for Healthcare Research and Quality (AHRQ) (Cook, et al., 2000), where they reviewed 154 articles on weaning predictors, of which 46 were RCTs and 25 were observational studies. The reviewed articles related to predictors of weaning readiness, of successfully sustaining a spontaneous breathing trial (SBT) and of weaning outcome in heterogeneous critically ill patients who required mechanical ventilation either via an endotracheal tube or a tracheostomy tube. The articles included in these reviews were characterised by diversity in terms of study objectives, methodological designs and targeted populations.

### **2.3.1 PREDICTORS OF READINESS TO WEAN**

MacIntyre (2009) summarised the best criteria from RCTs for assessing a patient's readiness to initiate the weaning process. He reported that objective measurements refer to adequate oxygenation manifested with a partial pressure of oxygen in the arterial blood (PaO<sub>2</sub>) of 60mmHg or 7.98kPa or a fraction of oxygen (FiO<sub>2</sub>) delivered from the ventilator less than 0.4. Moreover, the ratio of PaO<sub>2</sub>/FiO<sub>2</sub> should

be more than 150 to 300 and the PEEP requirements should be less than 5 to 8cmH<sub>2</sub>O. Other objective measurements are a stable blood pressure with no or minimal use of vasoactive drugs, a temperature of less than 38°C, normal blood pH, adequate haemoglobin (Hb > 8-10 g/dl), acceptable electrolytes and be rousable (GCS<sup>2</sup> > 13/15) with no continuous sedative infusions. However, most studies reported that the decision to initiate weaning was based on the subjective clinical judgment of physicians that the acute phase of the disease was resolved or was resolving.

The assessment of patients' reversed clinical condition that precipitated mechanical ventilation is based on various combinations of subjective and objective criteria (such as improvement of mental status, cardiovascular stability, improvement of gas exchange), which have not been evaluated with RCTs. In two old trials by Brochard, et al. (1994) and Esteban, et al. (1995), the clinicians did not recognise the feasibility of initiating weaning, although the patients selected had obvious signs of a resolving disease. This signifies that once some clinical evidence of stability in the patient's condition is apparent, there is potential for weaning with more focussed assessment of the patient.

To measure the patients' readiness to wean, Burns, et al. (1991) developed the Burns Wean Assessment Program, a 26-factor bedside worksheet used to assess weaning potential. This tool included 26 respiratory and general categories of factors with specific thresholds. The proportionate score of positive answers was expressed as a percentage. The scale was tested and compared with the other five indexes and was found that a score of 64% correlated with the ability to spontaneously breathe for 24 hours (Burns, et al., 1991).

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<sup>2</sup> GCS: Glasgow Coma Scale is a scale of assessing a patient's conscious level and rates from 3 (unconscious) to 15 (awake, alert and orientated to place and time). The scale measures the eye and motor reactions of the patient and the verbal response. For an awake and alert intubated patient that cannot respond verbally because of the endotracheal tube, the best GCS score is 10 out of 10.

In a later study, Burns, Ryan and Burns (2000) used this tool to identify the threshold scores of when to start a weaning trial, when to rest and when to assign to a weaning protocol for each stage of the weaning continuum and to test whether the clinical tools designed to quantify severity of illness may identify the stages of weaning. Ninety seven patients who were ventilated for more than 3 days were assigned to the study and data were collected three times a week for 6 months from the acute phase until the patient was discharged or transferred to another hospital or died.

The study concluded that although the clinical tools of severity of illness allowed distinction between the stages of weaning, they did not distinguish the weaning outcome stage. Moreover, the Wean Index, which included only respiratory factors, did not appear to identify the patient's stability and weaning ability. The conclusion was that indexes that include multidimensional predictors (physiological and respiratory parameters) have more predictive power of weaning readiness than the unidimensional indexes. In this study, patients spent less time in the weaning and outcome stage than in the acute and pre-weaning stage; therefore the scores of the indexes were not equal between the stages; that was a limitation of the study. Further studies that include different patient populations and follow the patients intensively over the course of ventilation are needed to establish the stage-specific scores for predictive models of weaning readiness (Burns, Ryan and Burns, 2000).

Soo-Hoo and Park (2002), in a survey with 102 respiratory therapists in a community in the USA, demonstrated that there is great variation in how respiratory therapists obtain weaning parameters. They demonstrated that there was a lot of variance in the parameters measured, the method and time used for measurement and the variability in the ventilator mode used to collect these parameters.

Four parameters were reported by 90% of the respiratory therapists and were the Mean Inspiratory Pressure (MIP), the tidal volume ( $V_t$ ), the respiratory rate ( $f$ ) and the minute volume ( $V_e$ ). The Rapid Shallow Breathing Index (RSBI) that is considered to be one of the parameters with the highest predictability (MacIntyre, 2001) was reported only by 20% of the participants. The investigators explained that

this parameter was not specifically reported but it was easily calculated by the respiratory rate and the tidal volume (f/Vt ratio). The results of this study highlighted the fact that the clinical utility of the weaning parameters was debatable and reinforced the need for further standardisation of the techniques for their measurement. Only when these parameters are standardised and accurately reflect the patient's readiness to wean, can they be incorporated into the clinical decision-making during the weaning process.

### 2.3.2 PREDICTORS OF WEANING OUTCOME

Previous studies between 1990 and 1999 have demonstrated that the RSBI, the work of breathing (WOB) and the oxygen cost of breathing (OCOB) are reliable predictors of the weaning outcome, although there is still debate about their threshold values. In a prospective observational study of 20 patients ventilated for more than 7 days who had failed attempts of weaning, Miwa, et al., (2003) evaluated the use of the OCOB as a predictor of weaning outcome, using a standardised weaning approach. They measured oxygen consumption (VO<sub>2</sub>) and energy expenditure (EE) with calorimetry continuously during a weaning trial, using also baseline physiological parameters before and after the weaning trial. They found, by multivariate analysis, that the OCOB and the average respiratory rate were statistically significant predictors of the weaning outcome. The threshold value for the OCOB was determined to be 30% and adequate to evaluate the imposed load from a trial of spontaneous breathing.

This cut off value of OCOB, however, differed from Mitsuoka, et al.'s (2001) study, because they obtained values of the oxygen consumption only before and after the trial and not continuously as in Miwa, et al.'s (2003) study. Both studies, however, supported that the predictive value of oxygen consumption (VO<sub>2</sub>) was higher than parameters such as the RSBI, f, Vt, and Ve and concluded that continuous monitoring of VO<sub>2</sub> may be a useful guide in decisions about reducing mechanical ventilatory support in patients undergoing prolonged weaning.



Despite the plethora of studies on predictors of weaning outcome, Meade, et al. (2001) concluded that most of the indexes studied have no predictive power. Some predictors, such as the RSBI (Yang and Tobin, 1991), the ratio of mouth occlusion pressure measured 0.1seconds after the onset of inspiratory effort (P0.1) (Vassilakopoulos, Zakynthinos and Roussos, 1998) and the Compliance-Rate-Oxygenation-Pressure (CROP) index (Alvisi, et al., 2000) have been studied the most and have some predictive power. For the RSBI it was found that the pooled likelihood ratio for a positive test ranged from 1.3 to 2.8 (Cook, et al., 2000).

Meade, et al. (2001) explained that the reason why these predictors have been found to perform poorly is because the physicians have not been blinded to the parameters being analysed and they have considered the results when selecting the patients for the study. MacIntyre (2009) stressed that the given parameters have been measured with many different techniques from study to study, therefore, reducing the validity of the results. What is more, these studies did not offer objective criteria to determine the patient's tolerance of efforts to discontinue mechanical ventilation and the definition of the outcome was in many times vague. For instance, some studies examined tolerance or failure of a spontaneous breathing, whereas others considered a successful extubation from 24 to 72 hours free from ventilatory support (Meade, et al., 2001).

Aboussouan, et al., (2005), in their prospective observational study, sought to identify the predictors of time to weaning of 103 long-term ventilated patients who were admitted in a specialised respiratory care unit in a community in USA. Following a specific weaning protocol, they assessed variables that have been identified in previous studies as predictors of weaning success in ICU. In their multivariate analysis, they concluded that only the RSBI and static compliance in combination and the creatinine level were independent predictors of the time to weaning. They indicated that the time to wean determined the disposition on hospital discharge and planning of resource allocation. They specified that the median time to weaning of 31 days in patients with high RSBI and high compliance was nearly

equivalent to the geometric mean length of stay for such patients, beyond which hospitals may not recover the costs of care (DoH and HS, 2003). This could have an implication on classifying early enough patients who will benefit from an admission to a specialised respiratory care centre.

Yang and Tobin (1991) established the threshold values of different weaning indexes reflecting respiratory mechanics, pulmonary gas exchange, control of breathing, and inspiratory muscle function in a highly non-homogeneous patient population. They assessed the predictive power of the threshold value for each index in another non-homogeneous patient population and found that the RSBI was the most accurate predictor of weaning outcome. However, the values of the indexes varied remarkably among the non-homogeneous patient populations due to the abnormalities of the respiratory mechanics.

Similarly, Alvisi, et al. (2000) studied these values in a homogenous population of patients with COPD. In their prospective observational study in a single site ICU, they recruited 28 COPD patients, admitted with acute respiratory failure either because of airway infection and pneumonia or because of sepsis, who failed a trial of spontaneous breathing. The physicians who made the decision to initiate a weaning trial, extubate or re-institute mechanical ventilation were blinded to the weaning indexes used.

Table 2.2 shows the threshold values for predicting weaning outcome that were found in this study and those that Yang and Tobin (1991) had previously established. Alvisi, et al. (2000) concluded that for COPD patients who have failed a trial of spontaneous breathing, these values differed compared to non-homogenous patient population due to the different respiratory mechanics and abnormalities. For example, the threshold values of  $f$  and  $V_e$  were lower than those found by Yang and Tobin (1991), whereas the threshold values of the Maximum Inspiratory Pressure (MIP) were higher.

| Weaning index                                    | Yang & Tobin (1991) | Alvisi, et al. (2000) |
|--|---------------------|-----------------------|
| Respiratory rate (f) (breaths/minute)            | <38                 | <25                   |
| Tidal volume (Vt) (ml)                           | >325                | >340                  |
| Minute volume (Ve) (l/min)                       | <15                 | <8.6                  |
| Mean Inspiratory Pressure (MIP) (cmH20)          | >15                 | >44                   |
| Arterial/alveolar pressure of oxygen (PaO2/PAO2) | >0.35               | >0.46                 |
| Efficient compliance (Crs,eff) (ml/cmH20)        | >22                 | >24                   |
| Static compliance (Crs,st) (ml/cmH20)            | >33                 | >54                   |
| $\Delta$ Pi/MIP                                  | <0.3                | <0.41                 |
| RSBI (breaths/min*1)                             | <100                | <84                   |
| CROP (ml/breaths*min)                            | >13                 | >16                   |

**Table 2.2 Indexes for predicting weaning outcome**<sup>3</sup>

It should be noted that the measurements of indexes were performed with the same methods between the two studies; therefore the differences in values found reflect the differences between the populations studied. The authors suggested that using MIP,  $\Delta$ Pi/MIP and CROP indexes may be candidates for a gold standard index for weaning COPD patients. A larger study, however, is needed to establish the use of these parameters as predictors of weaning outcome.

A few observational studies have focused on evaluating the use of minute ventilation recovery time (VeRT) as a practical measure of the ability to sustain spontaneous breathing and of predicting weaning outcome (Martinez, et al., 2003; Seymour, et al., 2006; Hernandez, et al., 2007). The minute ventilation recovery time (VeRT) is the time required for minute ventilation to return to baseline after a successful trial of spontaneous breathing. In Martinez, et al. (2003) study, the baseline minute ventilation was the subjective visual inspection of the trends of Ve to determine the nadir value. In this study, spontaneous breathing was performed with a T-piece for 2 hours in 69 patients. The decision to extubate the patient was made by the physicians in charge after assessing the patient's ability to wean based on baseline respiratory

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<sup>3</sup> Summarised from Yang and Tobin (1991) and Alvisi et al (2000).

parameters. The physicians were blinded to the criteria used. Patients who failed a T-piece trial were weaned gradually using pressure support ventilation (PSV). Fifty-nine patients were successfully extubated (85.5%), while 10 patients (14.5%) were re-intubated after 7 days.

The results of the study indicated that RSBI, post-trial  $\dot{V}_E$  and  $\dot{V}_{E\text{RT}}$  were predictors of extubation outcome. Because of a small sample size, a threshold value was not identified, but it was suggested to be around 4 minutes. The authors hypothesised that  $\dot{V}_{E\text{RT}}$  reflected the patient's respiratory reserve after a trial of spontaneous breathing. A limitation of Martinez, et al. (2003) study was the measurement of the baseline  $\dot{V}_E$ . This limitation was addressed by two more studies that evaluated the use of the  $\dot{V}_{E\text{RT}}$  as a predictor of weaning outcome.

Seymour, et al. (2006) used three methods to measure baseline  $\dot{V}_E$  before initiating a SBT in 19 post-operative patients, whereas Hernandez, et al. (2007) used a minute-to-minute sequential monitoring of  $\dot{V}_E$  after placing the patient back on mechanical ventilation after a successful trial of spontaneous breathing in 93 neurological and non-neurological patients. Statistical analysis in both studies revealed different positive predictive values of the  $\dot{V}_{E\text{RT}}$  for extubation outcome. This difference could be a reflection of the different patient cases and sample sizes used in each study suggesting that  $\dot{V}_{E\text{RT}}$  should not be used yet to guide clinical decisions regarding extubation. Larger randomized studies are needed to evaluate this index and identify a threshold value with high predictive power.

Further larger studies used a combination of respiratory and other physiological parameters following an imposed work of breathing to provide additional insight into the ability of a patient to sustain a spontaneous breathing trial (SBT). Nemer, et al. (2009) evaluated a new integrative weaning index (IWI) in a RCT of 331 patients who were ventilated for more than 24 hours. Their aim was to test the predictive performance of the index for the weaning outcome and identify its threshold value. The index they introduced combined three parameters; the static compliance ( $C_{rs,st}$ ) as an indication of the mechanical condition of the lungs and the chest wall, which

was associated with a shorter time to weaning when more than 20ml/cmH<sub>2</sub>O (Aboussouan, et al., 2005); the saturation of oxygen in the arterioles (SpO<sub>2</sub>), which has proven to be useful to evaluate the readiness of weaning or to indicate the weaning failure (Eskandar and Apostolakis, 2007; Boles, et al., 2007; Girard and Ely, 2008) and provided information on the patient's capacity to maintain a desirable oxygenation; and the RSBI, which informed about the patient's capacity to maintain an unassisted breathing (MacIntyre, et al., 2001; Vassilakopoulos, Zakynthinos and Roussos, 1998). The investigators compared the predictive values of the IWI with the RSBI, CROP and airway occlusion pressure (P0.1) and concluded that the IWI had the highest positive predictive value but also the highest negative predictive value, signifying that it was a useful index to detect those patients who passed a SBT but needed re-intubation. Further randomised trials are needed to test the accuracy of the IWI to predict the weaning outcome.

Raurich, et al. (2008) tested the use of the hypercapnia test in predicting the weaning failure. They induced increasing dead space of the ventilatory tubing, which caused re-inhalation of exhaled air. As weaning failure, it was considered the failure of a SBT or failure of extubation. They measured the values of hypercapnic ventilatory response and hypercapnic-respiratory-drive response of 103 intubated patients ready to be weaned. They concluded that the hypercapnia test was not a predictor of weaning outcome. Previous studies testing the predictability of the hypercapnia test have had conflicting findings (Montgomery, et al., 1987; Pourriat, et al., 1992). This could be due to the different methods used to induce hypercapnia and to the methods measuring the indexes studied as well as the different populations of patients among the studies.

The use of weaning indexes to predict weaning outcome has also been tested by Walsh, et al. (2004) in a prospective observational cohort study. The investigators developed a checklist of metabolic, cardiovascular and respiratory criteria based on the latest systematic reviews of the literature (Butler, et al., 1999; Meade, et al., 2001) to prompt the initiation of the weaning process. They tested the compliance of

using the checklist and its relation to the ventilation outcome. The outcome of weaning was considered the ultimate ventilator independence.

The authors concluded that the patients who met the criteria on day 1 or 2 after admission (120 patients out of 170) were weaned successfully suggesting that for these patients the weaning criteria could be used to trigger a reduction of sedation, a SBT or protocolized reduction of ventilatory support or extubation without the involvement of physicians. The patients who met the criteria after more than 3 days (50 patients out of 170) had a more variable weaning duration. For these patients, the weaning criteria could also be used to trigger reduction of sedation and ventilatory support but additional evaluation by the medical staff is required. Although this study was not blinded in the use of the checklist, but rather a clinician not involved in the decision-making collected the data, it suggested that a weaning checklist can prompt early identification of patients able to wean.

Another physiological parameter studied as a predictor of weaning outcome was the fluid balance. Prospective studies by Vukcevic, et al. (2002), Upadya, et al. (2003), and Epstein and Peerless (2006) investigated the impact of fluid balance on weaning, and indicated that fluid balance was significantly more negative in patients who were successfully weaned than in those who were not. Although it is known that mechanical ventilation induces gradual fluid retention after 48 to 72 hours of positive pressure ventilatory support, there are limited studies that evaluate the effectiveness of aggressive diuresis in critically ill patients. Nevertheless, Epstein and Peerless (2006) suggested that surgical patients may benefit from active diuresis to facilitate their weaning from mechanical ventilation.

Assessment of the patient's tolerance to sustain a SBT has been based on objective and subjective, from clinical assessment, criteria. These criteria are summarised in table 2.3 and were identified in RCTs, which focused on the assessment of the patients' respiratory system while receiving ventilatory support or while sustaining a SBT (Meade, et al., 2001).

|   |  |
|---|--|
| <b>Objective criteria for assessing tolerance of SBT</b>        | <b>Acceptable gas exchange:</b><br>PaO <sub>2</sub> > 50-60mmHg, PaCO <sub>2</sub> < 10mmHg, pH > 7.32, SpO <sub>2</sub> > 85-90%<br><b>Cardiovascular stability:</b><br>Heart Rate < 120beats/min, 90 < Systolic Blood Pressure < 180-200mmHg, no inotropes required<br><b>Work of breathing (WOB):</b><br>f < 30 breaths/min, f not changed > 50%, Vt: 325-408ml (or 4-6ml/kg), RSBI: 60-105/L, Ve: 10-15L/min, MIP: 15-30cmH <sub>2</sub> O, P0.1/Pimax: 0.30 |
| <b>Subjective clinical criteria for assessing SBT tolerance</b> | <b>Change in mental status:</b> agitation, anxiety, drowsiness<br><b>Discomfort</b><br><b>Increased WOB:</b> use of accessory respiratory muscles, thoracic-abdominal paradox<br><b>Diaphoresis</b> (excessive sweating)   |

**Table 2.3 Objective and subjective criteria for assessing SBT tolerance<sup>4</sup>**

Although precise criteria to terminate a weaning trial have not been identified, Alia and Esteban (2000) reported that patients, who have high PaCO<sub>2</sub> or low PaO<sub>2</sub> in their arterial blood after a trial are considered to have failed the SBT. The decision to terminate a trial is based on clinical judgment and on the objective and subjective criteria that were mentioned earlier (Table 2.3). Alia and Esteban (2000) highlighted that RCTs are needed to compare the outcome of weaning based on either strict or less strict criteria for SBT tolerance.

Predictors of the weaning outcome relate also to the ability of the patient to maintain spontaneous breathing after removing the endotracheal tube. MacIntyre (2009) recommended that assessment of the patient's ability to protect the airway and assessment of the patency of the airway are mandatory before deciding on extubating. The criteria to assess the patients' ability are based on small observational studies. Such subjective criteria are the ability to cough and expectorate secretions, interaction of the patient with the care provided, the absence of excessive secretions and the frequency of suctioning.

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<sup>4</sup> Summarised from Meade et al., 2001.

Several studies between 2002 and 2004 have identified variables that related to the ability of the patient to protect the airway with the extubation outcome (Coplin, et al., 2000; Khamiees, et al., 2001; Esteban, et al., 2002; Smina, et al., 2003; Salam, et al., 2004). Inability to cough, and increased amount of secretions were reported as predictors of extubation failure. However, these studies were relatively small and conducted in single settings.

Frutos-Vivar and Esteban (2003) assessed the association of different variables with re-intubation in a multicenter international study. They collected data from 37 ICUs in eight countries. The investigators collected data on the volume of tracheal secretions, efficacy of cough, white blood cell count and high temperature, administration of sedatives and fluid balance during the 24 hours before extubation. The multivariate analysis and logistic regression revealed that the RSBI, a positive fluid balance and pneumonia, as the cause for initiating mechanical ventilation, were the best predictors of extubation failure, whereas cough strength, amount of secretions and level of consciousness were not associated with extubation failure. The combined predictive power of these variables was weak.

In comparison, other studies have shown that voluntary cough peak expiratory flow (PEF) or cough strength (Coplin, et al., 2000; Smina, et al., 2003; Salam, et al., 2004;), amount of secretions (Coplin, et al., 2000; Khamiees, et al., 2001; Salam, et al., 2004, El Solh, et al., 2004) and pre-extubation mental status (Namen, et al., 2001; Salam, et al., 2004) could predict extubation outcome in patients who successfully pass a SBT. Smina, et al. (2003) speculated that patients with weak coughs are less able to sustain long-term spontaneous ventilation and protect their airway and remarked that this was the first study that used an objective, inexpensive and reproducible measure of cough strength, which increased its replication with larger studies.

A prospective observational cohort study by Mokhlesi, et al. (2007) assessed the relationship between the variables mental status, secretions and pre-extubation PaCO<sub>2</sub> with re-intubation within 48 hours after extubation in order to develop a



single clinical prediction rule to help decision-making. They enrolled 122 ventilated patients from 4 ICUs, who have tolerated a SBT. In the multivariable logistic regression model, three variables were identified as independent predictors of re-intubation within 48 hours of extubation; moderate or copious secretions; GCS score less than 10; and pre-extubation hypercapnia ( $\text{PaCO}_2 > 44 \text{ mmHg}$ ). There were no statistically significant interactions found. They found that patients with moderate secretions and GCS less than 10 had a 69% probability to fail the extubation.

In a prospective, non-randomised study by Solsona, et al. (2009) focused on predicting extubation failure with the introduction of added dead space in a pilot sample of 152 candidate patients for extubation. Patients, who fulfilled the weaning criteria based on the Consensus Conference on weaning (Slutsky, 1993) tolerated a 2-hour SBT with T-piece. The results revealed that the only variable independently associated with extubation failure was the intercostal retraction during the SBT. Patients who failed extubation presented with intercostal retraction as the first sign of increased work of breathing, but no other signs were detected because the patients were connected to the ventilator as soon as there were signs of deterioration.

This was the first study to use the stress test (with an added dead space) to determine the likelihood of extubation failure and suggested that tolerance of added work of breathing demonstrates the capacity of respiratory musculature reserves and the capacity to maintain greater breathing efforts for a longer time. A larger study, where decision-makers of the patients' ventilation will be blinded, is needed to confirm the usefulness of the stress test to predict extubation outcome. Nevertheless, this study suggested that observing intercostal retraction may help detect extubation failure.

Given that most studies that focus on identifying factors that predict weaning outcome have compared heterogeneous populations of patients who have failed or passed a SBT, they provided indirect measurements of respiratory muscle function and the respiratory mechanics have been studied when the patients have been passively ventilated. In a study by Carlucci, et al. (2009), the investigators recorded the respiratory mechanics during a SBT in order to understand the mechanism that

enables a particular patient to be weaned after having a previous failed weaning attempt. This applies mainly to the difficult-to-wean patients.

In this prospective observational study, 30 patients with a tracheostomy admitted in a weaning centre were enrolled in the study after they had a first failed attempt of weaning with a T-piece trial for 1 hour. The investigators measured the force-generating capacity of the diaphragm ( $P_{dimax}$ ) and showed that the patients who successfully underwent a SBT had a significant increase in  $P_{dimax}$ , which allowed an improvement in the load balance ( $P_{disw}/P_{dimax}$ ) and consequently a reduction of the tension-time diaphragmatic index. Although this study was the first physiological study using the patients as their own control, its design (before-and-after study) did not increase validity of the results.

What Carlucci, et al. (2009) showed was that difficult-to-wean patients, who have failed a weaning trial, appeared to have a ventilator dependency due to a reduced maximum transdiaphragmatic pressure ( $P_{dimax}$ ) rather than to an excessive workload, which implied that as soon as they were liberated from the ventilator, the threshold of the diaphragm fatigue increased. Therefore, the recovery of the inadequate inspiratory muscle force could be a major determinant of late weaning success since this allows the patient to breathe far below the diaphragm fatigue threshold. Previous studies have also supported this (Jubran and Tobin, 1997; Purro, et al., 2000).

The studies on predicting weaning outcome have generated an abundance of criteria with small predictive power failing to present a 'gold standard' criterion to guide decision-making. The main reason is the heterogeneity of the population of patients involved and the different methodological designs used for the studies. It became obvious, however, that there is limited information on the management of difficult-to-wean patients, which signifies the intricacy in designing methodologically robust studies that will lead to consistency of these patients' respiratory and weaning management.

### 2.3.3 PSYCHOLOGICAL AND OTHER FACTORS THAT IMPACT ON WEANING

Although the psychological stress of ICU treatment has been acknowledged in many studies in the last 30 years, the psychological condition of the patient through the weaning journey has not been considered in studies that investigated predictors or management of weaning (Bergbom-Engberg and Haljamae, 1992). One of the reasons is that psychological readiness is subjective and there are no objective criteria that can measure it. Psychological readiness can have many manifestations, such as discomfort, anxiety, fear, insecurity, pain, uncertainty and loss of control, and loneliness (Bergbom-Engberg and Haljamae, 1992). These factors have been studied but have not been linked to the weaning process and patient outcome.

A recent survey in Sweden investigated the criteria that were considered and documented by clinicians during weaning from mechanical ventilation in 92 ICUs (Mårtensson and Fridlund, 2002). The response rate was 66% (61 of 92 ICUs), but 12 ICUs were excluded because they managed patients with ventilation time less than 24 hours. Nutrition, communication, analgesics and sedatives, psychological and metabolic factors, weaning indexes and weaning approaches were considered during weaning. Psychological factors and communication methods were mentioned by the nursing staff mainly and were documented more in the nursing notes rather than the medical notes. The authors advocated that nurses are in the best position to assess the patient's psychological wellbeing during weaning since they work in close proximity to the patient and the relatives and therefore have a more holistic view of the patient's readiness to proceed with weaning.

Another parameter that has been studied within the ICU population, but has not been assessed in studies of weaning from mechanical ventilation, is pain. The above survey by Mårtensson and Fridlund (2002) did not present pain as a factor that clinicians considered in the patients' assessment. This gap was addressed by a recent prospective cohort study, the DOLOREA study, which stressed the necessity of assessing pain in nonverbal ICU patients and investigated its impact on the weaning time and ICU length of stay (Payen, et al., 2009). The investigators compared 513

ICU patients who were assessed for pain using the instrument implemented in each ICU with 631 patients who were not assessed for pain. Clinical practices regarding sedation and pain management were recorded for each group on day 2 and 6 of ICU stay. Mechanically ventilated patients were recruited in the study from 44 ICUs in France and Luxembourg and were followed throughout their weaning process until ICU discharge, or until 30 days in ICU or until death.

The descriptive statistical analysis revealed that patients who were assessed for pain received fewer hypnotic drugs, but their pain was managed with analgesics at an early stage (on day 2). Moreover, those patients had a shorter length of stay in ICU compared to the group that was not assessed for pain, but no significant difference was found regarding mortality. In terms of weaning time, assessment of pain was strongly associated with the time to liberate from the ventilator. The study did not provide an indication of the best tool to measure pain for ICU patients, but it clearly demonstrated that there is need for pain assessment in nonverbal ICU patients and that it should be used in conjunction with sedation scales so as to avoid inappropriate use of hypnotic drugs to treat pain.

The relation between mechanical ventilation time and sedation has been explored in previous studies on daily interruptions of sedation based on sedation protocols, which showed that frequent interruptions and less doses of sedation resulted in fewer days of mechanical ventilation (Kress et al., 2000; De Jonghe, et al., 2005; Mehta, et al., 2008; de Wit, et al., 2008). A few randomised trials have proved that there is superiority in using opioids compared to hypnotics in the management of agitation or patient discomfort when weaning from mechanical ventilation (Breen, et al., 2005; Muellejans, et al., 2006). Clearly, these studies provided an insight into the careful management of sedation level and its relation to successful weaning and length of ventilation

## **2.4 MANAGEMENT OF WEANING**

The MacMaster Evidence-Based Group on weaning from mechanical ventilation reviewed 16 RCTs, from 1975 to 1999, related to the management of weaning patients (Meade, et al., 2001). Eight studies focused on trials of discontinuation strategies (Feeley, et al., 1975; Hastings, et al., 1980; Jones, et al., 1991; Abalos, et al., 1992; Schirmer, et al., 1994; Bailey, et al., 1995; Esteban, et al., 1997, 1999), four trials explored stepwise reduction of mechanical ventilation (Brochard, et al., 1994; Jounieaux, et al., 1994; Esteban, et al., 1995; Girault, et al., 1999), and three trials compared different modes of ventilation for patients ventilated for less than 48 hours (Chopin, et al., 1989; Davis, et al., 1989; Esen, et al., 1992).

Both Butler, et al. (1999) and Alia and Esteban (2000) commented on studies that investigated the best method to wean ventilator dependent patients. Butler, et al. (1999) in their systematic review referred to 4 RCTs that were conducted between 1989 and 1995 (Tomlinson, et al., 1989; Brochard, et al., 1994; Esen, et al., 1992; Esteban, et al., 1995). Those studies compared three techniques (T-piece, SIMV and PSV) of weaning difficult-to-wean patients, whereas Alia and Esteban (2000) compared only the studies by Brochard, et al. (1994) and Esteban, et al. (1995). They both concluded that these studies, although very well designed, did not provide an answer to the best approach of weaning ventilator dependent patients, because their results were conflicting (Brochard, et al., 1994 versus Esteban, et al., 1995), and used different criteria in identifying the patient's tolerance of the weaning technique and different criteria for extubating patients. However, they admitted that these studies showed that the manner in which these techniques were applied affected the pace of weaning.

The eight RCTs, which focused on trials of discontinuation assessment strategies, included a variety of samples ranging from 22 to 526 patients, but five of them did not describe the method of randomization, whereas another five did not describe the method of concealment. All trials but two reported the weaning criteria that were used during the discontinuation strategies, but only five studies reported the

extubation criteria. Meade, et al. (2001) stated that the two studies by Esteban, et al. (1997, 1999) were the most methodologically strong, because they explained the randomization method, the concealment method and the criteria used for discontinuing mechanical ventilation.

The first study by Esteban, et al. (1997) compared a 2-hour trial with pressure support (PS) ventilation of 7cmH<sub>2</sub>O with a 2-hour trial with a T-piece. The authors did not report however the use of PEEP in the PS group. It was found that 14% of patients in the PS group failed to tolerate the trial in comparison to 22% of patients in the T-piece group (RR: 0.64; CI 95% (0.43-0.94)). The second study by Esteban, et al. (1999) compared a 30-minute trial with a T-piece to a 2-hour trial with a T-piece prior to extubation. No difference in the re-intubation rate was reported between the two groups, but patients who were randomized to the 30-minute trial had a significantly shorter ICU and hospital length of stay. The other six studies compared T-piece with either Continuous Positive Airway Pressure (CPAP) or PS strategies, but they did not provide any significant results, given the small sample sizes and the wide 95% confidence intervals that were found.

The five RCTs that focused on methods of reducing ventilatory support for patients who did not extubate in the first 24 hours, involved samples between 19 to 130 patients. Only one reported the method of randomisation (Esteban, et al., 1995), although two studies used sealed envelopes to ensure concealment of randomisation (Brochard, et al., 1994; Esteban, et al., 1995). All studies reported the weaning and extubation criteria, whereas Esteban, et al. (1995) reported also the re-intubation criteria. The above studies compared three modes of reduction of respiratory support by PS, T-piece and SIMV in patients who have failed a T-piece trial and presented the most informative results.

Esteban, et al. (1995), also, compared multiple trials of T-piece with a single trial, which did not show any significant difference in the duration of weaning. The two trials presented conflicting results when they compared T-piece with PS trials. Esteban, et al. (1995) favoured T-piece trials, whereas Brochard, et al. (1994)

favoured the PS trials. However, both studies did not show any significant difference in the duration of ventilation or re-intubation rate between the two methods of unassisted breathing. Comparing T-piece with SIMV trials and PS with SIMV, both studies showed a superiority of the T-piece trial and PS in the duration of ventilation. Meade, et al. (2001) stated that the comparison of these studies was feasible because they used similar populations and similar criteria for weaning, extubation and re-intubation.

Another study compared SIMV with and without PS, without the use of CPAP, and showed a reduction in the length of weaning time by one day in the group with the PS (Jounieaux, et al., 1994). Two more studies (Nava, et al., 1998; Girault, et al., 1999) demonstrated a reduced ventilation time with the use of Nasal Positive Pressure Ventilation for COPD patients who had failed an unassisted breathing trial. They both reported the extubation criteria used but not the weaning or re-intubation criteria. However, the above studies included small samples and did not describe the method of randomisation and concealment.

The three RCTs (Chopin, et al., 1989; Davis, et al., 1989; Esen, et al., 1992) that compared alternative weaning methods for patients ventilated less than 48 hours were methodologically weak, because they included small sample sizes, less than 42 patients; they did not report the randomisation strategy and concealment; and they did not describe the extubation or re-intubation criteria. All three studies, however, showed an inferiority of Intermittent Mandatory Ventilation (IMV) with respect to the duration of ventilation, compared to other modes, such as T-piece, Mandatory Minute Ventilation (MMV) or PS.

A prospective analysis of 586 patients who had undergone cardiac surgery compared three weaning modes: T-piece, SIMV and Bilevel (PS with CPAP) (Rathgeber, et al., 1997). The results showed superiority in the effect of Bilevel ventilation over T-piece trials or SIMV on the duration of ventilation, which is in accordance with the results from the above RCTs.

In summary, the results of the above RCTs on the modes of ventilation for weaning suggested an advantage of using Bilevel (PS and CPAP) for gradual withdrawal of ventilatory support and a possible advantage of 30-minute T-piece trial versus a 2-hour T-piece trial for weaning COPD patients. However, as Meade, et al. (2001) highlighted, these trials were based on clinicians' judgment that the patient was ready for weaning and had discrepancies in the use of different criteria to judge readiness to wean. Moreover, there was a difference in the threshold values of the criteria used, which created uncertainty about the impact of these values on the measured outcome. For example, in studies that used high thresholds in criteria and had low failure rates, it was difficult to distinguish a difference in the methods of weaning used, unless the sample was very high. Moreover, most RCTs, although they described the criteria that prompted clinicians to start weaning the patient, they presented different outcomes for similar criteria. This generated questions about aspects of the decision-making process that were not considered and failed to be elucidated in these studies.

#### 2.4.1 MANAGING THE PATIENT WHO HAS FAILED A SBT

The main questions that need to be answered regarding the management of a patient who has failed a SBT are the causes of the failure and the subsequent management of that patient. More specifically, whether another SBT should be tried, when and in what form, are issues that clinicians need to resolve. However, it is difficult to evaluate the studies that have been conducted regarding the management of these patients, because, even though they described the modes of ventilation they used, they did not evaluate the management philosophies and aggressiveness in reducing the ventilatory support. Moreover, these studies included different populations making their comparison even more complicated.

Once the reason of failure has been identified and corrected, three RCTs have supported the subsequent use of routine SBT for patients who had failed attempts of weaning (Brochard, et al., 1994; Esteban, et al., 1995; Ely, et al., 1996). Jubran and Tobin (1997) proved that failure of a SBT is due to abnormalities of the respiratory



system that need time to resolve. It has been suggested by studies in healthy subjects that the recovery time of the lungs can take more than 24 hours; therefore, patients who fail a SBT should receive a stable and comfortable form of ventilatory support.

The effect of a gradual reduction of support in between the SBTs in comparison to a stable unchanged level of support between the SBTs has not been proved. It has been suggested that gradual reduction of support can accelerate the conditioning of the respiratory muscles because of the ventilatory loads that are placed on the muscles and that the transition to extubation or to another SBT is easier from a lower level of support (MacIntyre, 2009). Esteban, et al. (1995) showed a superiority of using a stable level of support in between the SBT compared to just gradual reduction of support with PSV or SIMV.

However, it has not been addressed whether a combination of SBTs and a gradual reduction of support in between the SBTs offered any advantages. Generally, gradual reduction of support has been proved to be beneficial for the long-term ventilated patient, but none of these studies has offered adequate evidence (Esen, et al., 1992; Brochard, et al., 1994; Jounieaux, et al., 1994). Most studies agreed that the clinical focus should be on muscle unloading and optimisation of comfort and avoidance of complications for the patient (MacIntyre, 2009).

Lately some studies have been conducted with automated modes of ventilation and a knowledge-based system for adjusting pressure support (Dojat, et al., 2000).

Although these systems have been shown to be safe for reducing the ventilatory support, they have not been compared to daily SBT approaches.

#### 2.4.2 THE INTRODUCTION OF PROTOCOLS TO FACILITATE DECISIONS DURING THE WEANING PROCESS

The aim of the weaning protocols is to reduce the time spent on mechanical ventilation, and therefore minimise the potential complications from mechanical ventilation. However, the existing evidence supporting their use in clinical practice is

inconsistent. The most reliable evidence on the use of protocols for weaning come from the recent Cochrane systematic review by Blackwood, et al. (2010) on the effect of protocolized versus non-protocolized weaning for reducing the duration of mechanically ventilated patients in intensive care. Studies on protocolized weaning imply that nurses or respiratory therapists make decisions on adjustments of the ventilatory settings based on a specific algorithm.

Blackwood, et al. (2010) in their systematic review searched for randomized and quasi-randomized trials of protocolized weaning from mechanical ventilation. They reviewed 11 studies (9 RCTs and 2 quasi-experimental studies) that looked at the use of nurse-led or respiratory therapist-led weaning versus usual care and automated weaning versus usual care. These studies were conducted in a variety of clinical settings, mainly in the USA, and included samples between 15 and 357 patients. Participants were recruited from medical (Strickland, et al., 1993; Ely, et al., 1996, 1999, 2001; Kollef, et al., 1997; Marelich, et al., 2000; Krishnan, et al., 2004), coronary (Ely, et al., 1996; Piotto, et al., 2008), surgical (Kollef, et al., 1997; Stahl, et al., 2009), surgical and trauma (Marelich, et al., 2000), mixed (Rose, et al., 2008), neurosurgical (Namen, et al., 2001; Navalesi, et al., 2008) and cardiac surgical (Simeone, et al., 2002) units.

Description of the '*usual care*' in these studies was not explained in detail. Some studies mentioned the modes of ventilation used for the '*usual care*' (Strickland, et al., 1993; Marelich, et al., 2000; Piotto, et al., 2008; Rose, et al., 2008; Stahl, et al., 2009), whereas others mentioned that usual care was based on physicians' discretion without giving a detailed description (Ely, et al., 1996; Kollef, et al., 1997; Namen, et al., 2001; Simeone, et al., 2002; Navalesi, et al., 2008). This lack of information on what constituted '*usual care*' in each study created controversy in the results, which Blackwood, et al. (2010) suggested should be treated with caution. Indeed, for some ICUs usual care might involve a standardised and high level evidence approach to weaning and thus represent best practice, whereas for other units it might involve a variable and unfavourable practice. For instance, in Marelich, et al. (2000) and Rose,

et al. (2008) studies, the usual care involved continuous assessment of the patient, criteria for readiness to wean and extubation, 24 hour medical staff cover and one-to-one nurse: patient ratio and a standardised objective approach to ventilatory adjustments. These examples suggested that use of a weaning protocol may not provide further benefits for the weaning patient when a standardised evidence-based approach is used.

Furthermore, the criteria that were incorporated in the weaning protocols to guide decisions in these studies were very different, which can explain the different results from the studies. Blinding of the clinicians who used these criteria was not possible in most of the studies, which could have affected clinicians' behaviour when weaning the patient, increasing the bias in the interpretation of results. The studies included involved different patient populations and different settings, which made difficult the comparison of protocols and their effect on specific patient populations. Only two studies used the same protocol (Ely, et al., 1996; Kollef, et al., 1997).

The pooled summaries from these studies showed that protocolized weaning compared to usual care reduced significantly the total duration of mechanical ventilation by an average of 25% in geometric mean and the weaning duration by an average of 78% in geometric mean. However, no significant differences were found regarding the ICU or hospital length of stay, or on the adverse effects, such as re-intubation, self-extubation, and tracheostomy. The meta-analysis, though, had little power to provide such results (Blackwood, et al., 2010). Blackwood, et al. (2010) concluded that in units where objective criteria and guided approaches are already incorporated into standard weaning practices, further beneficial effects of protocolized weaning may not be gained on these outcomes. The authors suggested that future studies should report in detail the weaning approaches used and take into account the contextual and intervention factors that impact on protocolized weaning.

#### 2.4.3 MULTIDISCIPLINARY APPROACHES TO WEANING

Following the work of investigators on weaning protocols and their effectiveness in weaning mechanically ventilated patients and reducing duration of mechanical ventilation, White, et al. (2010) conducted a systematic review on the impact of ventilator weaning protocols implemented by multidisciplinary teams (MDTs) on the duration of weaning. The authors built on the systematic review by Ely, et al. (2001) on weaning protocols, who established that non-physician or nurse-led weaning protocols were more effective than usual care led by physicians, and recommended that strategies for weaning protocols should be developed by MDTs. MacIntyre, et al. (2001) and Cook, et al. (2000) supported this view as well.

White, et al. (2010) investigated the evidence from 1999 to 2009, for multidisciplinary developed and implemented protocols in weaning mechanically ventilated patients in ICU. They searched for controlled trials (randomized and non-randomized) of adult patients who were mechanically ventilated via an endotracheal tube, which used a weaning protocol that was implemented by a MDT. The main outcome of the review was the impact of the MDT weaning on the duration of mechanical ventilation, but other outcomes were the length of stay in ICU, re-intubation rates, incidence of tracheostomy and mortality. The review had many exclusion criteria, which caused publication bias.

The authors identified three prospective pre and post controlled trials, which were all conducted in single settings in the USA (Smyrniotis, et al., 2002; Grap, et al., 2003; McLean, et al., 2006). The samples used in each study were between 129 (McLean, et al., 2006) and 928 (Grap, et al., 2002). Two studies (McLean, et al., 2006; Grap, et al., 2003) compared MDT weaning versus usual care, but McLean, et al. (2006) did not specify the MDT approach. Smyrniotis, et al. (2002) compared protocol and organisational change versus usual care. The concealment allocation system used in all these studies was quasi-randomization, which implied that neither physicians nor patients or the data collectors were blinded to the intervention, causing bias on the findings. However, White, et al. (2010) argued that for the design of these studies,

blinding was not possible, but a description of the sample was pivotal so as to limit the heterogeneity of the studies included in the review.

Smyrniotis, et al. (2002) and McLean, et al. (2006) described the characteristics of the sample enabling comparison of the studies, but Grap, et al. (2003) did not describe the control and intervention groups, therefore, no conclusions could be made. Moreover, lack of description of the characteristics of the sample caused bias in interpreting the findings of the studies.

All three studies showed that MDT protocol-directed weaning reduced the duration of mechanical ventilation statistically significantly from 1.41 to 0.5 days. The two studies (Smyrniotis, et al., 2002; Grap, et al., 2003) which measured ICU length of stay found a significant difference between MDT weaning and usual care. Smyrniotis, et al. (2002) and McLean, et al. (2006) who measured re-intubation rate showed also a significant difference between MDT weaning and usual care. White, et al. (2010) could not compare mortality and tracheostomy incidence because these were not measured by all studies.

One of the limitations of these studies was that they used varied methods to collect data, which could have caused bias in the quality and quantity of data collected (White, et al., 2010). Moreover, lack of information on the usual care that these studies described, made difficult the comparison with the usual care in other countries, such as the United Kingdom (UK) and Australia.

The structure of ICU care in North America, where these studies were conducted, involves one nurse looking after more than one patient with the use of the respiratory therapists in decisions regarding mechanical ventilation and weaning, compared to the UK, Australia and other European countries, where nurses have an increased role in decisions made on weaning (Blackwood, 2000). The standard approach to weaning in North America differs from the standard approach to weaning in other countries, which makes it difficult to conclude whether a MDT approach has a

significant impact on weaning in other countries where a consistent approach is followed anyway.

White, et al. (2010) suggested that on-going collaboration of the key stakeholders of decisions made during the weaning process in implementing, reviewing and updating the approach to weaning is essential to improve the weaning outcome of the patient. The existing literature on multidisciplinary weaning management has failed to consider aspects of the clinical environment that can influence the implementation and adherence to weaning protocols and ensure a consistent approach to reductions of the ventilatory support.

## 2.5 CONCLUSION

The literature review focused on conceptualising the process of weaning from mechanical ventilation and highlighted the most recent evidence about the predictors of readiness to wean, the predictors of weaning outcome and the best approaches to reduce ventilatory support. The management of difficult-to-wean patients is part of the agenda for weaning studies, but there is still limited information on the best approaches and predictors to guide clinical decisions.

However, the studies discussed in this chapter clearly demonstrated that there are no gold standard criteria of readiness to wean and extubation success, with the exception of RSBI, P0.1 and CROP indexes, which have some positive predictive power. Moreover, no single method of weaning for stepwise reductions in ventilatory support showed a significant effect of reducing ventilatory and weaning time. Most studies supported that low levels of pressure support ventilation and T-piece trials appeared to be superior to SIMV mode for weaning long-term ventilated patients. The conclusion made out of the weaning literature is that the manner in which the weaning approach is applied is more significant for the patient outcome than the mode itself.

The research to date suggests that the best approach to initiating weaning is to develop a protocol implemented by nurses that tests for the ability to reduce the ventilatory support as early as possible and at every opportunity. These data advocate an advanced nursing role in the traditionally medically-led management of mechanical ventilation and its discontinuation. However, the lack of adequate data on the best approach to weaning implies that there is an unavoidable need for the use of clinical judgment when managing mechanically ventilated patients and their weaning. Clinical assessment is an integral role of the bedside nurse and requires the ability to identify the criteria of the patients' readiness to sustain reductions of ventilatory support or complete discontinuation. Recognizing the thresholds for ventilation weaning signifies the use of knowledge and judgment in making the appropriate decisions and applying the suitable weaning method for the patient.

Understanding how clinicians use the available information to make weaning decisions even with the presence of weaning protocols is of significant importance, because we can recognise the manner that weaning approaches are applied. Clearly, the literature review demonstrated a lack of evidence on this area.



## CHAPTER THREE

### PRINCIPLES OF DECISION-MAKING

## **CHAPTER THREE**

### **PRINCIPLES OF DECISION-MAKING**

#### **3.0 INTRODUCTION**

Mechanical ventilation is a classic example of technological development used to improve the management and outcome of critically ill patients. Critical care nurses have to process information that not only monitors and ventilators provide, but also information from clinical observation of the patient. Performing these disparate assessment and management procedures requires prompt and competent decision-making in order to make accurate decisions and avoid adverse effects. In the current climate of reduced health-care budgets that patients require more technology, increasingly complex management and shorter intensive care and hospital stay, the need for rapid and efficient decision-making is even more demanding. As nurses' decisions have an impact on patient outcome, it is imperative to explore their decision-making processes.

Gaining a deep understanding of nurses' decision-making processes has important benefits for the patient, the nurses and the employing organisation. At the individual level of the clinician, the nurse, consolidation of the elements that lead correctly to predicted outcomes and re-evaluation of those that do not will increase nurses' self-knowledge and awareness and will enhance clinical effectiveness. Consequently, this will facilitate both professional and health service policy aspiration to achieve patient focused health care provision (Buckingham and Adams, 2000). In the clinical practice of weaning from mechanical ventilation, thorough understanding of decision-making could be translated into identifying the appropriate method of weaning and extubation management, and consequently, reducing the risk of adverse effects of mechanical ventilation.

Nurses have struggled to articulate the nature of their expertise, scope of practice and claim of their professional status (Freidson, 1970; Witz, 1992; MacDonald, 1995).

Constant organisational restructuring and multi-skilling initiatives have created a growing diversity among specialist and advanced practitioners and although they have led to an increased nursing role, including managerial and therapeutic, there is still confusion about nurses' professional role boundaries (Adams, et al., 2000). Given the financial constraints of the National Health Service in Europe and the UK and the consequent staffing problems, the move towards an expanding nursing role becomes even more crucial. To expand nurses' role and make better use of their knowledge and skills, it is important to understand their decision-making processes and uncover hidden aspects of nursing work, which are usually taken for granted and are given less priority.

However, nursing decisions can only be understood completely in context, when the organisational and cultural factors are also incorporated into the decision-making processes (Rashotte and Carnevale, 2004). More transparency in clinical decision-making processes within that context will enhance multidisciplinary work and will support quality management and clinical governance (Department of Health, 1998).

Decision-making is an important, pervasive intellectual activity of humans engaged in academic, professional and social aspects of everyday life (Arkes and Hammond, 1986). A long history of research into the psychology of thinking and human reasoning has resulted in a plethora of different decision-making theories and confusing terminology, because of the fact that each discipline considers decision-making processes in isolation rather than drawing on the general knowledge base of decision-making (Dowie and Elstein, 1988; Higgs and Jones, 1995).

This confusion has resulted in different definitions of decision-making. For instance, Arkes and Hammond (1986, p. 1) quoted Webster's Third New International Dictionary in their thesis of decision-making, which referred to '*judgment*' as '*the mental or intellectual process of forming an opinion or evaluation by discerning and comparing*' and the capacity of judgment is '*the power or ability to decide on the basis of evidence*'. Webster's definition of decision as '*the act of settling or terminating [...] by giving judgment on the matter at issue*' suggested that there is

little difference between judgment and decision-making and that decision-making is the cognitive process of reaching a decision.

Christensen and Griffith-Kenney (1990) described decision-making as discriminating thinking and an essential component of the nursing practice. Clark (1996) defined decision-making as a process that nurses use to gather information about patients, make hypotheses and evaluate them on the grounds of the data acquired with the view to provide nursing care. Other terms have described the above process; human judgment (Hammond, et al., 1975) and human problem solving (Newell and Simon, 1972). The principles of this work have been applied to the health care field and have been used in various terms, such as clinical judgment (Tanner, 1993; Gordon, et al., 1994), clinical problem solving (Elstein, Shulman and Sprafka, 1978; Kassirer and Gorry, 1978), clinical decision-making (Corcoran, 1986 a,b,c), clinical or diagnostic reasoning (Jones, 1988; Joseph and Patel, 1990; Johnson and Weber, 2001). These terms differ little in meaning, so for this report decision-making or clinical decision-making will be used throughout.

The definition of decision-making used for this thesis was based on the principles of information processing and concept attainment theories (Newell and Simon, 1972; Bruner, Goodnow and Austin, 1956). In nursing, decision-making has been defined as the process of collecting and integrating different aspects of information about a situation leading to the generation of alternative problems or hypotheses (Maule, 2001). One of these hypotheses is then chosen as the most appropriate way to achieve the desired goal. Because the decision-making process focuses on the performance of the individual, it may take place once or it may require repeated collection and analysis of information and review of the hypotheses generated until the desired goal is achieved. Therefore, the outcome of the generated hypotheses is always considered and included in the process.

This chapter focuses on describing the decision-making perspectives, normative, descriptive and prescriptive, and their application in the clinical setting. Discussion relates to the dual process theory of thinking and the role of heuristics and biases in

maximizing information processing ability. The literature also addresses the characteristics of intuition and expert decision-making in the clinical setting. Then, the focus moves on to the concept attainment theory and the research setting to study decision-making. Various methods for collecting and analysing data relative to the cognitive process of the decision-maker are mentioned. Finally, studies on decision-making in relation to the weaning practice are reviewed.

To support the discussion on decision-making perspectives, an extensive search of a variety of computerized databases was performed to identify the most recent work on clinical decision-making and its application in nursing practice focusing specifically on the weaning process. CINAHL, MEDLINE, British Nursing Index, Blackwell-Synergy, Science-Direct, the Cochrane Library and the Edinburgh University catalogue were searched for the period 1990-2010 using exact key words: decision-making, clinical decisions, clinical judgment, models of decision-making, weaning, mechanical ventilation, nurse or nursing. Approximately 650 articles were identified including full text, abstracts and reviews. Full text articles and reviews were chosen as primary data sources. Those that were used to support the literature review included recent studies conducted in Europe, the UK, Australasia, and the USA and covered a variety of hospital settings. Only the theories that related to clinical decision-making and nursing are presented here. Very few studies on clinical decision-making during the weaning process were identified, which signified a lack of knowledge of decision-making in weaning practice.

### **3.1 THEORETICAL DIVISIONS IN CLINICAL DECISION-MAKING**

#### **3.1.1 THE DUAL PROCESS THEORY OF JUDGMENT**

Much of the literature on nursing decision-making focuses on examining patterns of knowing based on theories of cognitive psychology, which have offered strong support in understanding the cognitive process of judgment and decision-making, and have offered a background in the use of various models to study nursing decision-making. More precisely, cognitive psychology suggests that there are two distinct cognitive systems in human mind, which are activated during decision-making according to the dual process theory of cognition (Paley, et al., 2007).

The System 1 (S1) is an automatic, intuitive, holistic, implicit and fast system, which delivers judgments as a result of an unconscious cognitive process based on innate inferences and associative learning relevant to the cultural environment of the decision-maker. In the nursing literature, this system is referred as N1 and becomes a generic way of referring to the non-scientific ways of knowing or to the 'professional craft knowledge' (Titchen and Ersser, 2001). These terms imply that N1 judgments are inevitably accurate (Paley, et al., 2007).

System 2 (S2) is a deliberate, rule-based, analytical, explicit and slow system, which is associated with a conscious and controlled cognitive process. It embodies the so called 'thinking' process of analysing data, making hypotheses and acting upon future possibilities. S2 makes use of the central working memory (Gathercole, 2003), copes efficiently with one task at the time by applying rules and protocols (Stanovich and West, 2000). In the nursing literature, this system is referred as N2. Both systems can be treated as cognitive processes and have judgment as output without the implication that either system necessarily results in knowledge (Paley, et al., 2007).

However, there is a crucial difference between N1/N2 distinction and S1/S2 distinction. In the nursing literature it has been supported that N1/N2 have equal weight and importance in identifying patterns of knowing (Stein, et al., 1998), they have a complementary role and meld together to produce 'the whole of knowing'

(Chinn and Kramer, 2004, p.12). However, cognitive psychologists support that intuitive judgment is a product of S1 and emphasize that the role of S2 is to ‘override or inhibit default responses emanating from S1’ (Evans, 2003, p. 456). Therefore, S2 acts within a supervisory capacity of monitoring and correcting the products of S1, in order to reduce the disposition to invalid inferences (Evans and Over, 2004).

The unequal relation between S1 and S2 can be explained with the use of heuristics and biases in decision-making, which often occur when people succumb to error and when S1 is not supervised by S2 (Kahneman, et al., 1982; Gilovich, et al., 2002; Paley, et al., 2007). The use of heuristics and biases has previously been linked with expert decision-making in the clinical arena and in particular in studies comparing expert and novice nurses. The role of heuristics is explained more in section 3.1.5.

In the context of the dual process theory, various models have been used to analyse nurses’ decision-making. In the nursing literature the analytic cognitive process of N2 (S2) has been represented with normative models of decision-making, whereas the automatic, intuitive process of N1 (S1) with intuition, pattern recognition or heuristic reasoning. These models will be explained in the following sections.

### 3.1.2 DECISION-MAKING MODELS IN THE CLINICAL ARENA

Decision-making processes have been studied from three major perspectives according to the research question; the normative, descriptive and prescriptive. The normative perspective focuses on how decisions can be best made, the descriptive on how decisions are actually made and the prescriptive on how decisions ought to be made to have better outcomes (Chapman and Sonnenberg, 2000).

Normative models of decision-making are the Bayesian theorem (Fischhoff and Beyth-Marom, 1988; Eddy and Clayton, 1988), the Expected Utility Theory or Multi-attribute Utility Theory, which are implemented to specific decisions within the decision analysis framework (Roberts and Sonnenberg, 2000). These models are

based on the premise that signs and symptoms (input) are presented to the clinician who is required to predict a corresponding diagnosis with a certain range of confidence (output) (Carnevale, 2001). The clinician estimates utilities and probabilities of health outcomes and the effectiveness of interventions based on 'gold standard' evidence supported in the literature, by guidelines or national databases and expert opinion (Ioannidis and Lau, 2000). Decision analysis incorporates the well-supported numbers into a process that considers the likelihood of outcomes resulting from various options and the values of those outcomes and guides decision-making (Chapman and Sonnenberg, 2000).

Descriptive models of decision-making aim to define the decision-making process and allow the understanding of knowledge use when practitioners make decisions. Work on descriptive approaches to study decision-making incorporate the Brunswik lens model (Brunswik, 1956), Subjective Expected Utility Theory (SEUT) (Edwards, 1954), information processing theory (Newell and Simon, 1972) and concept attainment theory (Bruner, Goodnow and Austin, 1956). The Social Judgment Theory can also be studied within a descriptive perspective. These models describe the cognitive processes used by the decision-maker that can be made explicit.

Much of the research on understanding how clinicians make decisions has included the investigation of heuristics and biases in judgments and decision-making under uncertainty (Kahneman, Slovic and Tversky, 1982). It is at this level that descriptive approaches are contrasted with normative principles. In complex decision situations that may include uncertainties and discontinuities, descriptive approaches of decision-making recognise the active role of the individuals in interpreting reality. Such approaches are based on the principles of Heideggarian phenomenology (Heidegger, 1962) and aim to provide an interpretation of everyday nursing care. Within this perspective, much of the literature on decision-making includes intuition, pattern recognition, and heuristic reasoning as part of the process of arriving at a judgment and there is much empirical evidence which support its legitimacy (Hammond, et al., 1966, 1967; Kahneman, Slovic and Tversky, 1982; Schön, 1983,



1988; Benner, et al., 1996, 1999; Offredy, 1998, 2002, Croskerry, 2002). More information on heuristics and biases in judgment and decision-making follows in section 3.1.5.

Prescriptive models of decision-making concern how decisions can be improved. One of the primary reasons for decision research in health is to improve decision-making with the goal of leading to better patient care and outcomes. Many of the normative or descriptive models can be incorporated into computerised decision support programmes or health policies that can inform and facilitate decision-making or can become embedded into a program of practice improvement. All these models and their application in nursing decision-making will be discussed in the following sections.

### 3.1.3 NORMATIVE PERSPECTIVE OF DECISION-MAKING

Decision-making research within a normative framework has focused on the processes that practitioners use to identify the correct diagnosis or clinical condition and select the most appropriate method for its management. The underlying assumption of these approaches has been that if practitioners could be taught how to make better decisions, they would make fewer poorer decisions and patient care would improve (Rashotte and Carnevale, 2004).

One of the most popular normative prescriptive models of decision-making is the Bayes theorem. Bayes Theorem was first described by Reverend Thomas Bayes in the mid-eighteenth century, but was revived in the mid 1950's. The theorem is a mathematical formula which calculates the impact of new information upon the probability of a judgment prior to that information being known (Fischhoff and Beyth-Marom, 1988). It dictates that upon discovering new evidence practitioners will adjust their degree of belief in the judgment.

The Bayesian theorem uses three probability concepts. The prior probability of an outcome (condition or disease) is its probability if there is no diagnostic evidence for

it (Fischhoff and Beyth-Marom, 1988). For a patient who requires mechanical ventilation, prior probability would be considered the probability of having Ventilator Associated Pneumonia (VAP) prior to testing for it. Posterior probability describes the probability of an event after obtaining relevant information, in this case, having positive results of bronchial lavage cultures to detect VAP. Finally, conditional probability is the incidence of joint occurrence of particular information, based on that an outcome is true given that another one is true. In other words, judgments about patient outcomes adjust with accumulating evidence modelled by the laws of probability (Fischhoff and Beyth-Marom, 1988).

The first studies investigating nurse decision-making (Kelly, 1966; Hammond, et al., 1967) followed this model, but soon pitfalls were identified. Hammond, et al. (1967) studied six nurses' clinical judgments of a diagnosis when additional information was provided. Nurses were asked to review 12 patient cases and comment on the probability of changing their initial diagnosis in the light of new information. Nurses were found to be reluctant to change their initial diagnosis despite the new and contradictory information, showing a conservative decision-making attitude.

The Bayes theorem has been rejected mainly because practitioners are more conservative than the model suggests. Moreover, the mechanistic approach and need for numerical data to estimate probabilities form a doubtful consideration of its applicability in humanistic individualised person-centred nursing care (Jones, 1988).

Anderson and Shanteau (1977) have critically evaluated the use of linear models, such as Bayes theorem, in human judgment, and they commented that they have a weak inference in understanding the process followed by the decision-maker, despite their effectiveness in providing maximal discrimination among causal explanations. Specifically in clinical judgment research, Bayes model has been applied very successfully to predict the outcome compared to the clinical judge, when the variables were well defined and quantified (Meehl, 1971; Dawes, 1971). However, the attempts to assess goodness of fit have relied on arbitrary scaling of predictor variables, which have not been very informative, because there is crossover

interaction among the variables that the model cannot identify. The lack of justified correlation among variables makes the model unreliable to explain the understanding of human judgment (Anderson and Shanteau, 1977).

Another normative model to study nursing decision-making is the Social Judgment Theory, which can be applied within both a prescriptive and descriptive framework (Hammond, et al., 1966). The Social Judgment Theory emphasizes the assumption that, in real life situation, people derive their judgments from the cues they perceive in that situation and tend to associate these cues with the particular situation by making assumptions (Yates, Veinott and Patalano, 2003). For instance, in trying to anticipate the performance of a weaning trial from mechanical ventilation, assuming that blood gas analysis tends to be predictive, a practitioner might pay attention to the values of PaO<sub>2</sub>, PaCO<sub>2</sub> and pH cues derived from blood gas analysis. The practitioner would place heavy emphasis on these cues assuming to be strongly associated with the performance of the patient during the weaning trial and less emphasis on other predictors. The accuracy of the practitioner's prediction would depend on the actual cue validities and redundancies and the correspondence between these and the practitioner's emphasis.

One way that Social Judgment Theory is social concerns the fact that different individuals when faced with the same problem or situation often disagree in their assumptions and predictions. This disagreement derives usually from the different cue validities and emphasis they put on particular cues and how reliably they execute their judgment policies (Yates, Veinott and Patalano, 2003). The Social Judgment Theory traces its origins to the probabilistic approach espoused by Egon Brunswik and his colleagues from the 1930s to the 1950s.

The Brunswik lens model has received widespread attention (Brunswik, 1956). The lens model stipulates that there is a relation between the environment and the behaviour of organisms in the environment. The basic idea of the model is that certain cues of the environment relate to the dependent variable and each cue has a linear correlation with a judgment that defines the dependent variable. The

correlation of the dependent variable with the cues portrays the true situation of the information under judgment and represents the right side of the lens. This is known as the judgment 'ecology'. Each cue has a weight and contributes to the 'ecology'. The correlation of each cue with the judgment made depicts how the decision maker interprets that information and represents the left side of the lens (Thomas, Wearing & Bennett, 1991). The clinician decision-maker attaches importance to cues in making clinical decisions. The 'lens' is the past experience of the decision maker which affects how cues (for example signs and symptoms in healthcare) are interpreted and actions implemented (Tanner, et al., 1987). The model uses multiple linear regression to calculate the weight for each cue.

The lens model has the capacity to be used in both a prescriptive and a descriptive manner. Prescriptively it can describe how decision makers should have used the information available while descriptively it can describe how decision makers used the information available. The correlation between the judgments made and the true outcome provide a measure of accuracy for the decision maker (Hammond, et al., 1964). The application of the lens model has the potential to provide baseline data to design and evaluate interventions to improve clinical judgments for a specific task (Thompson, et al., 2005).

The lens model was used in a series of work both in the medical and nursing field. In medical decision-making the Brunswik lens model has been applied to examine the relationship between clinical information and physician's assessments of haemodynamic status (Speroff, Connors and Dawson, 1989) and in diagnostic ability of pulmonary embolism by physicians (Wigton, et al., 1986). In nursing decision-making research, the lens model has been used to examine the amount and types of information nurses used during diagnostic inferences, as well as the ways in which this information was sought (Hammond, 1966; Hammond, et al., 1966a; Hammond, et al., 1966b; Hammond, et al., 1966c; Dowding and Thompson, 2003). These studies provided recognition of the complexity of the judgment process used by

nurses, in addition to identification of variation in the information and processes used.

More recently, Thompson, et al. (2005) used the Brunswik lens model and the principles of Social Judgment Theory to understand student nurses use of clinical information to diagnose hypovolemic shock in a simulated environment. The pre and post quasi experimental study examined changes of information usage in 23 student nurses undertaking a critical care course before and after a traditional lecture on the management of hypovolemic shock. The factorial analysis demonstrated that student nurses did not use the clinical information in a linear manner and that some clinical information was not well understood and incorporated in their clinical judgment. Although the design of the study is susceptible to significant threats of the validity of the results, the study illustrated that Social Judgment Theory and Brunswik lens model offer a valuable approach of planning and evaluating educational interventions of nurses.

Use of the lens model to study decision making within the health care setting continues to pose a number of difficulties. Due to the analytical methods involved in using this model, the simulated setting is usually preferred over the real setting for data collection. However, the study protocols do not contain the number or variety of variables present in the real setting, and variables are usually presented in a sequential and often incomplete manner, which differs in real-life clinical situations. Despite these problems, the lens model is useful for studying the processes used by clinicians to combine multiple aspects of information to make a decision.

One of the earliest known normative decision making models was that of Subjective Expected Utility Theory (SEUT). First described by Edwards in 1954, it has generally been accepted as a model which describes decision making under risk. In reality, risk or uncertainty is a component of most decision making scenarios and this model attempts to incorporate this component into the decision outcome. SEUT combines information about the probabilities of each possible outcome with the desirability or utility of each of these outcomes (Tanner, et al., 1987).

Within the health care setting and relatively to the management of mechanical ventilation and weaning, this model would be applied in the following way. A patient with Chronic Obstructive Pulmonary Disease (COPD) who has sustained respiratory failure that necessitated the introduction of an endotracheal tube and initiation of mechanical ventilation is faced with three options after the clinical condition is resolved. First option would be to have the endotracheal tube removed without the need for institution of non-invasive mechanical ventilation for the next 12 hours; second option would be to have the endotracheal tube removed with the possibility to institute non-invasive ventilation in the next 12 hours; finally, to have the endotracheal tube removed with the possibility of re-institution of invasive mechanical ventilation. The likelihood of each of these options would produce a score for each possible outcome depending on the value of desirability (or utility) that the decision-maker places on each of the outcomes. Clearly, this model embodies a risk associated with the various management options. The disadvantage of the model is the difficulty of assigning a probability and utility score on each potential outcome of every decision made.

A decision-making model based on the descriptive perspective is the Information Processing Theory, which derived from the work of Newell, Shaw and Simon (1958) on human problem solving. In the health care environment, this theory is applicable because health care professionals are assigned to solve problems related to patients' health. Problem solving was regarded, in earlier years, as a mystical, almost magical, human activity which remained unexplained (Simon and Newell, 1971). It was not until 1958, that Newell, Shaw, and Simon tried to find a statement in the literature that would explain what 'human problem solving' means. Failing to do so, they manufactured one of their own, which was used as a framework to support their study in programming a digital computer to perform problem-solving tasks that were difficult for humans. According to their definition, *'problem solving should predict the performance of a problem solver handling specified tasks, it should explain the processes used, the mechanisms that perform these processes and predict the*

*incidental phenomena that accompany problem solving*' (Newell, Shaw and Simon, 1958, p. 151).

From their research the Information Processing Theory emerged in 1970. The theory considers the human brain to consist of effectors, receptors and a control system for joining these. It postulates a control system which includes a number of memories that contain symbolized information and cues that connect to each other, a number of primitive information processes which operate on the information kept in memories and have known physical mechanisms and a perfect set of rules for combining these processes into whole programs for processing (Newell, Shaw and Simon, 1958; Ciafrani, 1984). According to this theory, the practitioner gathers information and organises it in patterns of cues; then generates hypotheses, which he or she confirms and rejects according to the interpretation of the available cues. Finally, a judgment is made based on the pros and cons of each possible outcome choosing the one that is favoured by the majority of evidence (Thompson, 1999).

The Information Processing Theory was applied to computerized programs which used simulation of human problems to predict possible ways of solution. It has also been one of the most influential descriptive theories of decision-making used in medicine and nursing. Numerous nursing studies have used this hypothetico-deductive model and concluded that nurses make judgments about patient care in a rational process (Putzier, et al., 1985; Corcoran, 1986a, b, c; Tanner, et al., 1987; White, et al., 1992; Van den Berg, 1996). Offredy (1998, 2002) and Elstein and Schwartz (2000) have shown that when the practitioner is faced with a case of uncertainty, this process is commonly used by both nurses and doctors.

The advantage of this frequently described decision making process is that it allows very complicated decisions to be made with little cognitive effort. The disadvantage, though, is that information which may be very relevant to the final outcome may not be introduced into the decision making process until quite late (Newell, Shaw and Simon, 1958).

The final approach used to study decision-making processes from a descriptive perspective is the concept attainment theory, which has its origins in the work by Bruner, Goodnow and Austin (1956). This theory uses the framework that the information processing theory offers to describe how decision-makers acquire and process the information they collect to make hypotheses and arrive at a decision. More detailed explanation of this theory is provided in section 3.2.

Concept attainment principles aided by verbal protocol analysis have been used in a simulated patient situation to identify the strategies used by nurses to attain concepts in clinical decision making (Gordon, 1980, 1987). Nurses were found to make a combination of single and multiple hypotheses, which remained active at any one time, in order to progress through the decision-making task. In addition, both state (historical or current variable characteristics of the person's condition) and contextual (non-varying or slowly changing characteristics of the person, event or situation) attributes were found to be used.

More recently, Aitken (1997) used the concept attainment theory and think aloud technique to understand expert critical care nurses' use of information when monitoring pulmonary artery pressure in critically ill patients. The study was conducted in the natural setting with eight expert critical care nurses who were asked to think aloud for two hours while managing a cardiac patient. The results of the study indicated that expert critical care nurses generally acquired a substantial amount of data or attributes including pulmonary artery pressure measurements and they clustered these attributes around three main concepts that described pulmonary artery monitoring. Participants validated both the attributes and the hypotheses generated with a range of decision-making strategies to improve accuracy in the decision-making process.

Researchers who used the concept attainment theory and the information processing theory have concluded that expert nurses use a greater number of cues than novices and that increased data or attributes have led to increased number of hypotheses being generated (Ciafrani, 1984; Itano, 1989). Much of the research within these last



two approaches, information processing and concept attainment, relies heavily on the use of verbal protocol analysis (section 3.3.3.1). The method of data collection provides a means of gaining insight into the decision makers' activities by verbalising, then tracing the processes as they occur. It overcomes a major problem associated with retrospective methods of data collection that of the subject making errors in reporting based on forgetfulness, post hoc rationalisation, unwillingness to admit mistakes and political or social pressures (Elstein and Bordage, 1988).

In summary, the normative framework provides a range of models which are appropriate to study both how a practitioner actually makes decisions but also how a practitioner should make decisions. The range of models presented can be used as a framework for studying decision making in the real setting as well as in the simulated setting. Specifically, much as the mathematical models, such as the Bayes theorem, are excellent for providing precise information regarding decisions made in a simulated setting, they are generally difficult to implement in the real setting due to the difficulty in quantifying many of the decisions which take place. On the other hand, descriptive models offer the advantage of being less mechanistic than the prescriptive models and therefore applicable in settings such as health care which operate with a philosophy of independent professional practice. In summary, the range of normative models available ensures that the decision making researcher is able to select an optimal framework based on the desired information to guide each study.

#### 3.1.4 INTUITION AND EXPERT DECISION-MAKING

In the decision-making research, phenomenological studies have recognised decision making as a network of interrelated projects, rather than identifiable progressive steps. Within the hermeneutic paradigm that phenomenology offers, nursing research has focused on the exploration of expert decision-making in various clinical fields, acknowledging the use of intuition and pattern recognition in the decision-making process.

Interpretive phenomenologists generally assume that analytic approaches to decision making are characteristics of a novice practitioner rather than an expert and consequently dispute the practice of using a normative framework to study expert practitioners' decision making strategies. In addition, they support that interpretive approaches have the potential to reveal the depth and diversity of nursing knowledge, because they allow for research which aims to understand the human phenomena rather than explain them; they allow for research that is conducted in natural, uncontrolled settings; and they allow for research which uses the knowledge embedded in experience (Mackey, 2005). Therefore, attempts have been made to investigate the characteristics of intuition using an interpretive perspective.

Phenomenology is an interpretive approach which has been introduced as a methodological structure in nursing studies and stems from the work of the two German philosophers; Edmund Husserl (1859-1938) and Martin Heidegger (1889-1976) (Crotty, 1996; Lawler, 1998). Paterson and Zderad (1976) first introduced phenomenology into nursing with their Theory of Humanistic Nursing. These theorists referred to the work of the original phenomenological philosophers, Husserl and Heidegger, and their theory reflected their understanding of these philosophers' work. Benner introduced phenomenology into the nursing area in the early 1980's when she placed strong emphasis on Heideggerian principles to describe the activities and processes which nurses use in general practice (Benner, Tanner and Chesla, 1984). This work was further expanded in 'Expertise in Nursing Practice' where it was recognised that *'... with experience concrete situations become coherent and help the practitioner develop a sense of doing better or worse, of recognizing similarities and differences, and of participating in common meanings and practices'* (Benner, Tanner and Chesla, 1996, p. xiv).

Intuition has been described in many different ways. For Benner and Tanner (1987, p. 23), intuition is *'understanding without a rationale'*, whereas for Rew (2000, p. 95), intuition is *'a component of complex judgment, the act of deciding what to do in a perplexing, often ambiguous and uncertain situation [...] it is the deliberate*

*application of knowledge, or understanding that is gained immediately as a whole and that is independently distinct from the usual, linear and analytical reasoning process*'. Similarly, Gerrity (1987, p. 63) suggested that intuition is '*a perception of possibilities, meaning and relationships by way of insight*' or '*an immediate knowing of something without the conscious use of reason*' (Schrader and Fischer, 1987, p. 45).

Pattern recognition is often associated with intuitive judgment (Benner and Tanner, 1987) and perception (Effken, 2001). In pattern recognition the nurse identifies a few critical pieces of information that fit to a category or pattern in which the patient belongs (Hedberg and Sätterlund-Larsson, 2003). The nurse compares the signs and presenting symptoms of a patient problem with patterns recognised from memory to match the presenting trend (Gordon, 1987). This ability of nurses to undertake pattern recognition develops as knowledge increases and as nurses gain experience in a specific area of nursing (Cioffi and Markham, 1997; Reichman and Yarandi, 2002; Aitken, 2003).

Pattern recognition happens in a conscious level unlike intuition which involves nurses' use of embodied knowledge based mostly on their experience to justify their decisions (Jenkins, 1985). With time, pattern recognition is replaced by more refined recognition patterns. This process is related to competence, the reduction of anxiety, the development of a sense of saliency and the ability to recognise the defining characteristics of a given clinical situation (Papa, et al., 1990; Jacavone and Dostal, 1992; Hoffman, et al., 2004). These characteristics correspond with nurses using an intuitive approach to clinical decision-making, which explains why intuition and pattern recognition are considered similar decision-making approaches (Banning, 2007). The main drawback of using pattern recognition or intuition as a decision-making tool is that the cues or attributes used may be associated with wrong decisions since the decision maker relies on memory to recognise cues that may be inaccurate.

A recent interpretive study was conducted in Sweden to describe how expert nurses make decisions on measures in clinical practice (Hedberg and Sätterlund-Larsson, 2003). In this small-scale exploratory study, six registered nurses were interviewed about the tools they used for making decisions and the interpretive content analysis revealed that they first observed the cues relating to the patient's situation then confirmed the information gathered and finally implemented action strategies. The identification of cues was assisted by knowledge of the patient and by nurses' knowledge, enabling the use of pattern recognition in their decision-making process. What is revealing is that nurses used the action strategy of '*one step ahead*' and '*carrying out measures*' in order to prepare themselves for an anticipated situation. The above activities can be present in decision-making models developed on the basis of a rationalist-analytical and an intuitive approach, a conclusion that has also been confirmed by Lauri, et al. (2001).

Another interpretive study focused on the use of intuition in nurses' postoperative assessment of patients returning from major surgery (King and Macleod-Clark, 2002). The sample involved 61 registered nurses in 3 hospitals in England. The participants were observed and interviewed in their clinical decision-making. The findings showed that intuitive and analytical elements were apparent in nurses' clinical decision-making from advanced beginners to expert nurses, but the latter could use intuition much more skilfully and effectively due to their depth of knowledge and experience.

Smith, et al. (2004) attempted to study intuition using psychometric testing and factor analysis. They found that nursing students experienced intuition in a similar manner to experienced nurses and identified seven factors that characterised the concept of intuition. These factors were relevant to physical sensations, such as gut feeling, emotional awareness and premonition, apprehension as well as anxiety and fear. These findings were consistent with previous studies (Buckingham and Adams, 2000; Ling and Luker, 2000; Hansten and Washburn, 2000; Khatri and Ng, 2000; King and Macleod-Clark, 2002).

Rew (2000) also explored the characteristics of intuition in a sample of psychiatric-mental health nurses studying on continuing educational courses. Factor analysis of the Acknowledges Using Intuition Nursing Scale (AUINS) revealed six characteristics of intuition; cautiousness and rigidity; self-awareness; being creative; willing to take risks; take risks; take actions based on intuition. These characteristics concurred with previous results (Rew, 1990; 1991). Both studies mentioned by Smith, et al. (2004) and Rew (2000) were small-scale studies with limited response rate. However, the findings reflected previous studies and suggested the need for a psychometric tool to test and develop theory pertinent to clinical decision-making.

In the critical care setting, a series of studies found that expert critical care nurses function at an entirely different level from novice critical care nurses (Benner, Tanner and Chesla, 1992). Expert nurses have a good grasp of the clinical situation, where important aspects stand out as salient and pattern recognition is a strong feature of their decision-making process (Aitken, 2003). Additionally, expert nurses' clinical behaviour has been characterised by a holistic nature, which is not apparent in novice nurses (Benner, Tanner and Chesla, 1996).

In summary, phenomenology allows for detailed data collection regarding individual events, and allows for integration of data from a variety of perspectives. However, it is susceptible to criticism. First, researchers have used and adapted phenomenological techniques to particular research questions, without justifying their appropriation; therefore, leading to the misuse of methodological notions (Maggs-Rapport, 2001). Crotty (1996) presented evidence from the nursing literature that there is confusion in the nursing phenomenological research as to the distinction between phenomenological methodology and philosophy. Most authors refer to the philosophical origins of the selected research approach but there are many differences in the way that these philosophical streams have been understood and applied in nursing literature (Dickson, 1994; Bell and Millward, 1999; Atsalos and Greenwood, 2001; Thomlinson, 2002).

Second, decision making studies conducted from an interpretive approach have generally used a retrospective method of data collection through interviews or story telling. These methods introduce the potential for bias because retrospective data collection provides the opportunity for participants to recollect and alter their interpretation of their clinical behaviour based on their knowledge of the outcome.

Third, a potential disadvantage in work conducted within the interpretive framework is that differences in interpretation of the data reside with the people involved and are dependent on their unique circumstances at the time the study is conducted. Despite these disadvantages, interpretive phenomenological studies have offered insight into the decision-making processes of expert nurses.

To conclude, nurses' ability to discern clinical information that is likely to lead to 'at risk' situations for their patients makes a difference to patient care and patient outcome (Cioffi, 1997, 2000). Intuitive judgments are a form of probability assessment that lead to inductive inferences being made in uncertain clinical decision-making environments, such as intensive care. The recognition that intuition is a cognitive skill indicates the relevance and necessity of exploring nurses' decision-making from the perspective of cognitive psychology (Rew, 1986, 1988; English, 1993). Cognitive psychologists have found that judgments made in uncertain situations are most commonly heuristic in nature; hence the application of heuristics in interpreting intuitive judgments may be of value in understanding the construction of these judgments by nurses (Tversky and Kahneman, 1973).

### 3.1.5 THE USE OF HEURISTICS TO MAXIMIZE INFORMATION PROCESS CAPABILITY

The decision-making models that prevail in the clinical field use mathematical or quantitative techniques objectively, rationally, dispassionately failing to take into account the lack of resources, interruptions or distraction, throughput pressures that frontline clinicians have to face in clinical reality. However, thinking and decision-making is an adaptive process that encompasses a variety of human factors (Vicente,

2003). Despite the 30-year research on decision-making approaches and the recognition of the importance of psychological factors, mainly, in medicine, there has been little acknowledgment by clinical decision theorists.

Decision-making in critical care nursing falls into the category of 'human factors' or more specifically 'non-technical skills' in which the majority of errors are likely to occur (Reason, 1990). These non-technical skills, which have been characterised by Benner, Tanner and Chesla (1984) as 'know how' nursing, constitute a major proportion of the qualities on which competence in nursing practice is based. A competent nurse recognises the uncertainty and potential complexity of a clinical case and steers his or her way around a variety of cognitive biases to make the correct decision. The trick lies in matching the appropriate cognitive activity to the particular task in order to achieve optimal situation awareness and good decision-making (Croskerry, 2005).

A variety of studies in the clinical setting have repeatedly demonstrated the importance of heuristics and biases in information processing and in establishing a clinical decision and diagnosis. Heuristics are rules of thumb, intuitions, abbreviations, simple judgments and short cuts that are activated when a clinician is facing a critical situation and is in need to maximise short term memory capacity by storing information in a variety of different formats (Croskerry, 2005). This approximation strategy allows a decision to be made and a corrective response to the patient's needs without invoking formal Bayesian reasoning.

Heuristics have been shown to explain nursing judgment in assessment situations and have been considered to be components of intuitive judgment (Benner and Wrubel, 1982; Rew, 1988; Benner and Tanner, 1987). Generally, heuristics are effective but occasionally fail to lead to good clinical decision-making, because they are influenced by a variety of cognitive biases, in particular when System 1 is not supervised by System 2. In such cases, clinicians 'assess probabilities incorrectly, test hypotheses inefficiently and over-project own beliefs to allow prior knowledge to become implicated in deductive reasoning' (Stanovich and West, 2003, p.171).

The risk faced here is that the decision-makers are overconfident in their mistaken assessments and are highly likely to be wrong in their associative thinking.

Variations on associative thinking have been illustrated with the attribute substitution, structural availability bias and belief bias (Paley, et al., 2007). Attribute substitution occurs when an assumption is cognitively tied to a proxy measure or attribute, termed 'attribute substitution' by Kahneman and Frederick (2002). For instance, a mechanically ventilated patient with increased body temperature is at risk of sepsis. This assumption is made based on the fact that high temperature is associated with sepsis, but on occasions it can produce the wrong judgment. Scientific thinking, S2 provides a check by testing for increased white cell count and the bacteria colonisation in the blood stream.

A second variation of association heuristic is the structural availability bias, in which case and assumption is made on the basis of the most available attribute in memory. The availability heuristic or anchor heuristic is employed when people are asked to assess the frequency of a class or the plausibility of a particular development. Buckingham and Adams (2000) correlated the 'exemplar' model of classification with the availability heuristic in that clinical decision-making is judged on the basis of recollection of experiences with patients presenting with the same condition. For instance, a patient with Chronic Obstructive Pulmonary Disease who needed mechanical ventilation due to exacerbation of his disease failed to wean off the ventilator because of the increased level of PaCO<sub>2</sub>. The association of the level of PaCO<sub>2</sub> in the blood gases cannot be considered the ultimate criterion for failing extubating trials. This error would have been avoided with a more systematic sampling strategy performed by System 2 (Dawes, 2006; Freytag and Fiedler, 2006).

A third variation of associative thinking is the belief bias, which occurs when an inference is based on an attribute which is already believed to be valid; therefore, the inference made is valid. For instance, a mechanically ventilated patient who has a Rapid Shallow Breathing Index (RSBI) more than 80 is believed that he will fail a spontaneous breathing trial.



Another heuristic, the representativeness heuristic, is usually employed when people are asked to judge the probability that an object or event belongs to a class or process. It focuses on the frequency of events that can be recognised and triggered in memory. Buckingham and Adams (2000) correlated this form of heuristic with the 'prototype' model of classification based on how representative or similar the nursing example is from the prototype.

The above heuristics were followed by eight other heuristics described by Dawson and Arkes in 1987, and by 2002 there were over 30 (Croskerry, 2002). Recently, the term Cognitive Disposition to Respond (CDR) has been proposed by Croskerry (2002, 2003) to include the cognitive biases that may influence decision-making. The heuristics described by Tversky and Kahneman are highly economical and usually effective, but they lead to systematic and predictable errors. The argument is that the risk of cognitive errors made by an unchecked and unsupervised S1 can be minimised with supervision exercised by S2 by applying logic, mathematics and probability calculus systematically to particular problems. This is supported by the dual process theory, mentioned earlier, which accepts that S1 is the default option in judgement and decision-making, but it is essential that S2 monitors the effectiveness of intuitively-driven behaviour (Degani, et al., 2006). In the clinical context, this translates in to evidence-based practice and the interrogation of other ways of knowing by scientific reasoning (Paley, et al., 2007).

### 3.1.6 THE COGNITIVE CONTINUUM IN CLINICAL DECISION-MAKING

The literature on decision-making suggests an equal account of the functions of S1 and S2 and provides an alternative to the dual process theory. Thompson (1998) and Buckingham and Adams (2000) were strong supporters of a '*middle ground*' theory of decision-making, because they reckoned that neither analytical nor intuitive theories explain in depth the process of decision-making. Research has proved that in clinical decisions these theories overlap each other and that they both have limitations in explaining how decisions are made (Thompson, 1998).

This '*middle ground*' theory is based on Hammond's cognitive continuum theory (Hamm, 1988). According to the propositions of this theory, the nature of any decision elicits a particular mode of thinking which ranges along a continuum between intuition at one end and analysis at the other (Hamm, 1988). It has been believed that more structured tasks incorporate fewer pieces of information and are amenable to the analytic approach, whereas less-structured tasks incorporate more information and elicit intuition. However, a recent review of 136 studies in medicine, psychology and psychiatry concluded that mechanical prediction by statistical prediction rules (SPRs) is typically as accurate or more accurate than clinical prediction (Grove, et al., 2000), and emphasised that SPRs outperformed experts and not novice clinicians. So, the idea that intuition is better suited to complex and ill-structured tasks than analytic processes is mistaken. The evidence suggests that selecting a small number of key variables from a complex situation and applying SPRs to them is often more effective than applying intuition to a greater number of variables or to the situation as a whole (Paley, et al., 2007).

A unifying model of decision-making which involves both hypothetico-deductive and intuitive approaches reinterpreted within a unifying psychological classification is well supported and in tune with the cognitive continuum theory. According to Buckingham and Adams (2000), the proposed unifying model of classification begins with gathering cues or objective data (pattern vector) based on the patient's condition according to signs or symptoms (feature vector) that the patient presents, which formulate associated categories (classes) relating to patient outcomes. During the formulation of classes both intuitive and analytical processes can be applied in order to shape decision classes (levels of support) (Thompson, 1998; Buckingham and Adams, 2000).

The advantage of the classification model is that the hypotheses are made very early in the process as cues are gathered and build support for categories (classes) to which they are connected, and sooner rather than later concepts occur which direct to further investigation of more focused data (Buckingham and Adams, 2000).

However, a problem of bias may occur as people tend to prove the truth of ideas instead of disproving them, which can be a risk of missing important cues during the process (Buckingham and Adams, 2000).

Other authors have commented on the continuous cognitive process of classification of decisions and have explained that the classification is based on the similarity of the case under investigation with a potential class, where this similarity can be measured in various ways (Jones, 1988; Taylor, 1997). Offredy (1998) and Radwin (1995) talked about the '*prototype*' and '*exemplar*' approach that nurses use to classify a situation. Both approaches are thought to involve pattern recognition, but no attempts have been made to elucidate whether they involve conscious or unconscious behaviour. The difference between these two concepts of classification, which are both based on a probabilistic relationship between object and potential class membership, is that the '*prototype*' represents a '*typical*' patient with the specific symptoms or signs without taking into account the number of patients manifested with the same presentation as in the '*exemplar*' approach (Buckingham and Adams, 2000).

## 3.2 CONCEPT ATTAINMENT THEORY

Nurses in their daily practice need to process information gathered from monitoring and assessment of the patients' condition in order to make either inductively or deductively a clinical judgment that will lead to a particular behaviour. The concept attainment theory offers a framework to understand how decision-makers acquire and process the information they collect to make hypotheses and arrive at a decision. Its elements are described in this section.

### 3.2.1 CATEGORIZING AND ITS ELEMENTS

The Concept Attainment Theory uses the attainment of concepts as a tool to understand and articulate a phenomenon. Despite the complexity of our environment and the plethora of distinctive characteristics of objects, events, people, impressions, humans have the exquisite capacity of making distinctions and registering the differences in things and respond to each event. In order to reduce this overwhelming complexity of the environment caused by encountering each event as unique, humans have the ability to categorise different things equivalent to groups of objects or events and respond to them in terms of their class membership rather than their uniqueness (Bruner, Goodnow and Austin, 1956). This discriminative activity is reserved for those elements of the environment that are of great concern. What is unique with the ability to categorise is that once the particular category is mastered, it can be used without further learning. The learning and utilization of categories represents one of the most elementary forms of cognition by which humans adjust to the environment.

There are two broad types of categorizing responses, which point to a different kind of category; the identity response and the equivalence response. Identity categorisation is defined as '*clustering a variety of elements as forms of the same thing*' (Bruner, Goodnow and Austin, 1956, p.3). Sheldon (1950) advocated that identity response, although still not clear, is affected by learning, but we still do not

know whether the capacity to recognise identity is innate and then developed by being exposed to new ranges of events or whether the capacity is itself learned. Michotte (1946) and later Piaget (1953) worked on this, but the question about taking identity categories as given is still open. Heraclitus stated that '*we never enter the same river twice*' implying that identity categories can be many times so equivocal that cause uncertainty and confusion (Bruner, Goodnow and Austin, 1956, p.3).

The second type of categorizing is the equivalence categorizing when '*we respond to a set of discernible different things as the same kind of thing or as amounting to the same thing*' (Bruner, Goodnow and Austin, 1956, p 4). Forms of grouping depend on whether or not things placed in the same class evoke a common affective response or a common functional response. Formal equivalence categories are constructed to describe the properties of the criteria that define a class using special artificial language to indicate the common categories.

The number of ways in which an array of events can be differentiated into classes varies with the ability of the individual to abstract features, which some of the events share and others do not. As Klüver (1933) highlighted, we can either select or abstract similar features by a coding process. It is a matter of interest to inquire how we form and apply this coding on similar features of a class of things, but also how systematic individual and cultural differences impact on categorizing behaviour.

The act of categorizing can occur in two levels, the perceptual and the conceptual level. In both levels, we categorise a set of objects or instances to a category based on the properties of the criteria or the attributes that operationally describe the object or the instance. The difference between them is that in the perceptual categorisation, the relevant attributes by which we judge the categorical identity of an object are given immediately, whereas in the conceptual categorisation the attainment of knowledge of the attributes is not immediate and requires difficult strategies of search. In the effort of searching for attributes, one can develop means of altering conceptual categories to categories that can be utilized with more immediate perceptual cues (Bruner, Goodnow and Austin, 1956). This is what distinguishes

experienced clinicians in the act of differential diagnosis of a disease; an expert clinician no longer needs elaborate searching of attributes to determine the nature of a syndrome or disease.

How categories are formed and used is relevant not only to the psychological aspect of cognition but also to anthropological aspect of culture. It should be noted at this stage that definition and categorisation of concepts are a projection of deep cultural trends into the experience of individuals (Bruner, Goodnow and Austin, 1956).

To sum up the benefits of categorizing, it is important to stress that categorizing reduces the complexity of events and tasks and their environment and therefore it reduces the necessity of constant searching and learning. It is a tool for identifying objects, events, tasks, ideas and can direct activity. Moreover, it permits the ordering and relating of classes of event, which helps the provision of a meaning to the event. Finally, it allows the exploration of counterfactual conditional events that are contrary to the experience.

### 3.2.2 VALIDATION OF CATEGORIZING

When inferring an event as a member of a class, and giving it identity, we need to make sure that we made the right inference. There are four different procedures which offer reassurance and validation of the inference made. The first is by *recourse to an ultimate criterion*, the second is *test by consistency*, the third is *test by consensus*, and the fourth is *test by affective congruence* (Bruner, Goodnow and Austin, 1956).

When testing *by recourse to an ultimate criterion*, validation of the adequacy of the defining attributes is made against an ultimate criterion. In such case, inventing signs or labels which exemplify the category can facilitate spotting of the particular attributes. Testing *by consistency* occurs when we search for regularity of the visible defining properties of the conception under investigation. Testing *by consensus* is activated when there is uncertainty and ambiguity about the defining properties of an

instance. In such case, one will search for an official method of categorizing, which in the clinical setting could be translated as a protocol, a guideline or the consensus from a senior expert clinician. Finally, testing *by affective congruence* is activated when an act of categorizing carries a feeling of subjective certainty or necessity. The affective component provides the validating criterion for categorizing.

### 3.2.3 CONCEPT ATTAINMENT THEORY AND ITS ELEMENTS

The concept attainment theory explains the behaviour involved in identifying the discriminating attributes of an inquiry, how they are combined to provide the maximum certainty to the inference made about the inquiry. The task of seeking defining attributes that will distinguish exemplars of a certain inquiry is called concept attainment (Bruner, Goodnow and Austin, 1956). The first step en route to attainment of a concept is called concept formation, which is the formation of a hypothesis that links some attributes together. *Attainment refers to the process of finding predictive defining attributes that distinguish exemplars from non-exemplars of the class one seeks to discriminate* (Bruner, Goodnow and Austin, 1956, p. 22). The definition of concept attainment theory was given by Bruner, in 1956, as the process of acquisition, retention and categorisation of attributes with the use of cognitive strategies in order to attain a hypothesis or concept (Bruner, Goodnow and Austin, 1956). The concept attainment theory has three elements, which are explained below: attributes; concepts; and strategies.

#### 3.2.3.1 Attributes

Attributes are a set of signs or properties that describe, discriminate and give identity to an object or an event. In the clinical setting, attributes are signs or symptoms of a disease, technical parameters observed from monitors, such as breath sounds, temperature, blood pressure, and medical history. Attributes have values and dimensions and are distinguished to defining and criterial attributes. Defining attributes are those that have an external statement of the defining properties and

have a scientific convention or a degree of correlation between the value of the attribute and the concept. An example of a defining attribute is the level of partial pressure of oxygen in the arterial blood, or else PaO<sub>2</sub>, which is measured with blood gas analysis. A PaO<sub>2</sub> of less than 9kPa signifies hypoxia, which is an attribute that describes respiratory failure.

When the discriminative features of a defining attribute are interpreted by an individual and are used as a means of inferring the identity of an object or event, the attribute is criterial. Criterial attributes can vary either continuously or discretely from event to event. For instance, radiological results are interpreted by the clinician who makes an inference of pneumonia in the view of lung consolidation.

In some cases, a range of positive values is used to define exemplars of a category. For instance, the existence of added breath sounds from auscultation and the presence of thick purulent secretions infer to the concept of chest infection. Clinicians use different widths of the range of positive values of an attribute for several reasons. Firstly, the training that the clinician received in discriminating properties of attributes between exemplars and non-exemplars of a concept affects the range of positive values of an attribute that he or she will use. Secondly, exposure to the variability of values of an attribute facilitates recognition of differences among values. Thirdly, the existence of more discriminating categories of the values of an attribute narrows the range of categories selected. Moreover, the range of attribute values that an individual regards as criterial is affected by personal ranging of the individual and by cultural usage. For instance, weaning protocols, which include a variety of attributes that can infer the ability of the patient to wean, are different to each other and among institutions. Finally, there is a threshold point where an attribute has a positive or negative value, which can determine the categorisation of an event.



### 3.2.3.2 Concepts

The second element in concept attainment theory is the concept, which is defined as a network of inferences, thoughts or ideas that is formed in the mind as a result of categorisation of attributes (Bruner, Goodnow and Austin, 1956, p. 41). Concepts are divided into three categories: conjunctive, disjunctive and relational concepts, each involving different modes of combining attributes.

A conjunctive category of concepts is defined by the joint presence of the appropriate value of several attributes. An example of conjunctive category is the combination of the attributes; a PaO<sub>2</sub> less than 9kPa, sense of breathlessness, and use of accessory muscles, indicate hypoxia and respiratory failure.

A disjunctive category of concepts is defined with the presence of several different attributes. For instance, identifying a patient able to be extubated is defined by several attributes that relate to the cardiovascular and respiratory stability of the patient and the level of alertness. When a patient has an acceptable level of PaO<sub>2</sub> that excludes hypoxia, the trend of his blood pressure is stable over a short period and is awake and cooperative, then the clinician can infer to the ability of the patient to extubate. Finally, the relational concept or category is defined by a specifiable relationship between the defining attributes.

When one forms and attains concepts, he uses rules to group a set of attribute values for defining the positive or exemplifying instances of a concept. The concept is, basically, this rule of grouping, and the attainment of a concept is based on more than one attribute categorised in the above way. Decision-makers use a combination of the above categories rather than concentrating on one. The strategies the decision-makers use to group the attributes and attain concepts are described below.

### 3.2.3.3 Strategies in concept attainment

A strategy in concept attainment theory is defined as a series of processes or mental operations in the acquisition, retention and utilization of information (Bruner,

Goodnow and Austin, 1956, p. 54). It is a subconscious process, which unless verbalised cannot be accessed. The strategies offer the opportunity to obtain information appropriate to the objectives of the inquiry. Another benefit of using a strategy is to increase or decrease the cognitive strain involved in assimilating information and facilitate keeping track of tenable or untenable hypotheses generated on the basis of information encountered. Thirdly, by following a certain order of selecting instances for testing one controls the degree of risk involved in attaining a concept. Testing instances in a certain order can guarantee either the rapid attainment of a concept with good luck or a very slow attainment without luck.

Before analysing the various strategies of concept attainment, it should be noted that a selection of a strategy is dependent on the nature of the concept sought, the pressures and resources that exist in the decision-making environment and the potential consequences of the decisions made. For example, there are decisions that are made as a routine of practice and others that are critical and need to be made immediately and with increased accuracy, such as in emergency situations.

Four main strategies have been used in concept attainment theory, which can also be used to analyse nurses' behaviour when weaning a mechanically ventilated patient. The strategies have been summarized in the table below (Table 3.1) in three domains; acquisition of attributes; generation of hypothesis; and validation of hypothesis made.

|                              | <b>Simultaneous Scanning</b>  | <b>Successive Scanning</b>   | <b>Conservative Focusing</b>   | <b>Focus Gambling</b>  |
|------------------------------|---|--|--|--|
| <b>Attribute acquisition</b> | Use each instance as an occasion for deducing which hypothesis to keep  | Choose instances containing a common positive attribute  | Find a positive instance to use as a focus<br>Each choice changes a single attribute value of the first focus based on positive and negative values  | Use of a positive instance as a focus<br>Change more than one attribute values at a time   |
| <b>Hypothesis generation</b> | Deal with many independent hypotheses that are carried in memory  | Make a single hypothesis at a time   | Develop a hypothesis that centres on the focus attribute<br>New hypothesis does not contain positive instances of the attribute values of the focus when changed   | Develop one hypothesis that centres the focus attribute<br>New hypotheses developed based on positive and negative attribute values                                    |
| <b>Hypothesis validation</b> | Eliminate as many hypothetical concepts<br>Deduce which hypotheses have been eliminated and carry the results in memory to inform further choice  | Test hypothesis until finding the correct concept<br>Selection of instances that provide a direct test of a hypothesis based on a positive or negative information   | Test the relevance of attributes<br>Consider the attribute values one at time and discard those not related<br>It requires an order of instances to be tested<br>Direct testing by selecting the attribute value that makes a change in the value of the focus | Testing by attribute relevance<br>Elimination of attribute values with positive results<br>When attribute values are negative, use of a Simultaneous Scanning strategy |
| <b>Summary</b>               | Elaborate analysis of the situation to determine the next step<br>Difficult to determine maximum information obtained for the next choice<br>Does not provide a way of regulating the riskiness of the choice | Reduction of cognitive strain by using direct test of hypothesis<br>Low regulation of risk, as definition of a multi-attribute hypothesis is based on guessing<br>Risk of discontinuity in learning<br>Does not assure maximum information acquired<br>Useful when cognitive process rough or when one has a good reason to believe that a particular hypothesis will turn out to be correct | New hypotheses do not contain redundant information<br>Direct testing decreases the complexity and abstractness of the task<br>Provides a safe choice because it guarantees presence of information, but not the maximum information provided                  | Does not guarantee avoidance of redundant instances<br>Direct testing of hypotheses about the relevant attributes<br>Reduces complexity by the use of focus attribute  |

**Table 3.1 Decision-making strategies as described in concept attainment theory**

### **3.3 STUDYING DECISION-MAKING IN THE CLINICAL SETTING**

The challenge of studying clinical decision-making remains on how to study effectively the decision-making processes in the uncertain and complex clinical environment, such as the critical care environment. Various schools of thought exist regarding whether this research is most appropriately conducted within the real clinical or simulated setting, what form of data collection should be used and how the data should be analysed and presented most effectively. Each of these areas will now be examined.

#### **3.3.1. SIMULATED VERSUS REAL CLINICAL ENVIRONMENT**

Much of the previous decision-making research has taken place in a simulated setting or with the use of patient scenarios. Simulations present lifelike situations with a good approximation of reality when based on real cases. Simulations allow easy control of the context of the situation and reproducibility; they have maximum relevance to the research question and cost little in time and resources to reuse for multiple subjects (Fonteyn, Kuipers and Grobe, 1993).

However, the external validity of the simulated setting has been questioned. Holzemer and McLaughlin (1988) advocated that the clinicians' behaviour and performance is different when measured in a simulated setting or when observed in real life. Researchers of medical decision-making acknowledged the difficulty in ensuring that the simulated setting reflects the real clinical setting (Page and Fielding, 1980; Henry, 1991a, b).

The rationale for using a simulated setting for studying decision-making is to avoid contamination of the research process. However, when the aim of the research is to understand how decisions are made during the care of the patient, it is important to consider various influencing factors including the patients' response to the treatment and other demands of the nurses' time. Interruptions, stress, the organisational

structure of the setting, unpredictability of the patients' condition, are elements that are difficult to incorporate in a simulated setting (Itano, 1989). Validation of the findings within a simulated setting is usually clear, immediate, frequent and direct, unlike the absent, indirect, delayed or ambiguous validation within the real setting (Bruner, Goodnow and Austin, 1956). This difference further limits the generalisability of findings in the simulated setting to application in real clinical practice.

In summary, the simulated setting cannot truly replicate the unpredictability and complexity of the clinical environment and would possibly obscure the thought processes that occur in real life situations (Fonteyn and Fischer, 1995). As a consequence the real setting is ideally suited to the study of decision making processes used by the critical care nurse as it is likely to provide accurate information regarding the genuine way clinical decisions are made.

### 3.3.2 DATA COLLECTION TECHNIQUES

Various methods of data collection have been used to study decision-making. In the field of critical care, interviews (Baumann and Bourbonnais, 1982; Benner, Tanner and Chesla, 1996), questionnaires (Ferrell, et al., 1991), computer simulations (Henry, 1991a, b), cognitive task analysis (Hoffman, et al., 1998) and verbal protocol analysis (Fonteyn and Fischer, 1995; Aitken, 2003) have been the most prevalent methods used either separately or in combination, such as interviews and observation.

Each method of data collection has advantages and disadvantages based on the aims of the study and the desired outcome. Interviews provide detailed information about a decision event, but this information depends on the memory of the interviewee; therefore, there is a risk of inaccuracy. Questionnaires are simple and inexpensive to administer to a large sample, but do not provide detailed information on the actual process of decision-making. Computer simulations provide a means of studying

decision-making in a controlled manner to maintain consistency within the participants, but require technical expertise and equipment. Moreover, they cannot capture unpredictable situations. Verbal protocol analysis offers an inexpensive and uncomplicated manner to study real life clinical decisions in detail and accuracy. Cognitive task analysis is also an accurate and detailed data collection technique, which can be used either retrospectively or concurrently. Finally, combinations of data collection methods may reduce the disadvantages of each technique used separately and offer greater detail and accuracy of information.

#### 3.3.2.1 Verbal protocol analysis

Verbal protocol analysis has been used in the field of health care and has been guided by the work of Ericsson and Simon (1993). This method uses the think aloud technique to elicit information on how nurses use assessment information to guide patient care and ultimately improve patient management. Participants are asked to think aloud while problem solving and their behaviour can be recorded and then analysed (Ericsson and Simon, 1993).

Verbal protocol analysis is based on the principles of Information Processing Theory by Newell and Simon (1972), which stipulates that the human mind processes information that is stored in the short-term or long-term memory and can be available according to the problem that needs to be solved. Information stored in the short-term memory is available instantly to the problem solver, but the capacity of short-term memory is limited. In the long-term memory information is stored as an enormous collection of nodes, which need to be transferred to the short-term memory to become available to the problem solver (Newell and Simon, 1972).

Verbal reports can be used either concurrently or retrospectively (Aitken and Mardegan, 2000). Concurrent verbal reports with the use of think aloud technique access the short-term memory and offer increased accuracy of the thinking process of the decision-maker as the decision task occurs. Retrospective verbal reports with the use of interviews can offer access to the long-term memory, but are susceptible to

inaccuracy of the cognitive process when used after a long time from the event (Aitken and Mardegan, 2000).

#### 3.3.2.2 Cognitive task analysis

Cognitive task analysis involves knowledge elicitation techniques that focus on making the embodied knowledge explicit and can involve interviews about retrospective accounts of incidents or observed samples of performance (Waternan, 1986). Researchers have adapted the cognitive task analysis (CTA) to study experienced decision-makers in their natural setting (Crandall and Getchell-Reiter, 1993; Hoffman, et al., 1998). Hoffman, et al. (1998) described one of the methods of CTA, the Critical Decision Method (CDM), which is based on Flanagan's critical incident technique (Flanagan, 1954).

The CDM employs a number of semi-structured interviews with specific focused probes designed to elicit particular types of information from the interviewee. These interviews are conducted based on a recent event that occurred in the decision-maker's work environment. The analysis of the incident is focused on decision points, shifts in situation assessment, critical cues leading to a specific assessment, cognitive strategies used and potential errors. The knowledge elicited from the interviews can be represented in a variety of ways, such as narrative accounts, cognitive requirement tables or cognitive concept maps (Pliske and Klein, 2003). In the field of critical care, this technique has been used to describe the cognitive processes that surrounded the assessment and care of critically ill infants (Crandall and Getchell-Reiter, 1993).

#### 3.3.3 DATA ANALYSIS AND PRESENTATION

Analysis of the data collected when studying clinical decision-making depends on the aims of the study and the desired outcome. There are various techniques that have been used to examine clinical decisions in a prescriptive or descriptive manner.

However, there is a major concern among researchers regarding the lack of formal objective methods for analyzing complex decision material (Joseph and Patel, 1990). Decision analysis, decision trees, protocol analysis, discourse analysis and concept maps are the predominant methods for studying decisions relevant to the clinical environment.

Decision analysis is a recognised technique specifically designed for unique decisions which are complex, uncertain and value laden (Jones, 1988). The decision analysis, as a technique, looks at the optimum answer for the patient and can provide patient specific outcomes. Decision analysis breaks down the decision task into a number of simple components (Jones, 1988). It has been criticised on the grounds that it is not useful for rapid decision-making and that it lacks descriptive fit (Bauman and Deber, 1989). This technique does not claim to describe what nurses do, but was developed as an alternative to human decision-making on the evidence that human judgment and decision-making can be demonstrably flawed (Harbison, 2001).

Decision analysis uses decision trees as a tool to present the data. Decision trees are flow charts that show all sequential paths representing combinations of decisions and the decision outcomes (Fryback, 1981). In the critical care field, protocols and guidelines usually have the form of a decision tree and inform patient care. An example is weaning protocols, which are algorithms that include specific cues and demonstrate different paths of reducing ventilatory support according to these cues. Decision trees are beneficial in that they force identification of the sequence of decisions that have been made, they clarify any uncertain factors and they clearly outline the consequences of each possible decision (Jones, 1988).

Verbal protocol analysis involves the identification of attributes or cues collected, the generation of hypotheses or diagnoses generated (Ericsson and Simon, 1993). The basic assumption that underlies the interpretation of verbal protocols is that only the information that is heeded in short-term memory can be processed further and verbalised directly (Ericsson and Simon, 1993). Discourse analysis focuses on a



detailed semantic description of the knowledge and the concepts contained within the decision-making process (Joseph and Patel, 1990).

#### 3.3.3.1 Concept maps

Concept maps are visual or graphical tools for organising and representing knowledge. They include concepts, usually enclosed in boxes and lines that link the concepts together. They were introduced by Joseph D. Novak (1984) for teaching students of science. They are based on the assimilation cognitive theory, which stresses that new concepts can be learnt based on existing knowledge (Ausubel, 1968). The role of cognitive maps in business and science has been previously studied and documented, but their use in research analysis is limited (McAleese, 1988; Anderson and Lebiere, 1998; Birbili, 2006). Concept maps use propositions, which are statements that establish a relationship between two or more concepts and are displayed as labelled lines in a concept map. In the study of clinical decision-making in the critical care environment, the concept maps can be used to present critical care nurses' thinking process and knowledge on mechanical ventilation and weaning while in real practice. The concept maps can derive from transcripts of think aloud or verbal reports and represent a roadmap of the decision-making process that each clinician applies.

### **3.4 THE CLINICAL PROBLEM**

Decision-making has three components: the decision-maker; the decision task; and the decision environment. The review of the literature on weaning from mechanical ventilation informed about the complexity of the decision task, providing an abundance of studies on the best criteria to predict weaning ability and the best approaches to weaning. On the other hand, the literature on decision-making focused mainly on the various theories and perspectives of studying decisions within the nursing field, elaborating on the decision-making processes used by clinicians. This section will discuss the recent literature that focuses specifically on the study of decision-making relative to mechanical ventilation and the weaning practices in critical care.

#### **3.4.1 CLINICAL DECISION-MAKING OF THE MECHANICALLY VENTILATED PATIENT**

Studies on clinical decision-making relevant to the management of mechanically ventilated patients have been central to the impact of multidisciplinary teams on the development of weaning plans or weaning protocols that facilitate clinicians' decision-making (Hughes, et al., 2001; Burns and Earven, 2002; Henneman, et al., 2002). Although many of the studies relating to weaning have compared nurse-led approaches to physician-led weaning, only Taylor (2006) explored the decision-making process of nurses and doctors when making decisions about the patients' weaning.

Taylor (2006) used a grounded theory approach to investigate nurses' and doctors' decision-making processes when weaning patients from mechanical ventilation based on a recently introduced nurse-led weaning strategy. Semi-structured interviews based on four real patient scenarios were conducted with three consultant anaesthetists and three nurses. Doctors and nurses used a variety of decision-making strategies both analytical and intuitive or in combination, which revolved around the concept of treatment, of maintaining a balance, of making a progress and of the

responses of the individual (the patient). These approaches coincided with findings by Offredy (1998) on nurses' and doctors' decision-making approaches in general practice. Trial and error was a common type of decision-making attitude, which might have reflected the complexity of weaning and the lack of an ideal tool to predict patients' weaning outcome.

Important differences were found between participants in their approaches to weaning. Approaches identified, interventionist and gradualist, have been supported by Elstein, et al. (1999) in their study examining physicians' decision-making behaviour. The conceptual investigation of weaning decision-making as a result of Taylor's (2006) study, illustrated the role of doctors in deciding on treatment options for the patient and the role of nurses in working with the patient during weaning. It also highlighted that the complexity of weaning decision-making necessitates a close collaboration between doctors and nurses in the weaning process.

Rose, et al. (2007) studied the role of Australian critical care nurses in managing mechanical ventilation and weaning practices of 474 critically ill patients in a prospective cohort study. Ventilation and weaning decisions involved adjustment of ventilatory settings such as mode of ventilation, tidal volume, pressure support, Positive End Expiratory Pressure (PEEP) and fraction of oxygen (FiO<sub>2</sub>). Of the 3986 decisions, 64% were made by nurses alone, 17% by medical staff and 19% in collaboration. The findings of this study demonstrated a great autonomy of nurses in weaning decision-making. It should be noted that the decision to extubate a patient and to change the PEEP setting on the ventilator was collaborative, but the decision to initiate weaning was made by the nurse in 80% of the cases. Rose, et al. (2007) advocated that the workforce profile and the organisational structure of the setting were responsible for the increased autonomy of nurses, since there was not an implemented weaning protocol. Rose, et al. (2007) agreed with Henneman, et al. (2002), Cohen, et al. (1991) and Wheelan, et al., (2003) that effective communication and planning by the multidisciplinary team results in most effective and advantageous clinical decision-making and improved patient outcome.

The findings of this study corresponded with a recent survey by Rose, et al. (2008) on the role responsibilities of Australian and New Zealand critical care nurses on mechanical ventilation and weaning practices. The results of the survey suggested that nurses participated actively in ventilation and weaning decisions and supported an association of this autonomy with the collaborative decision-making culture of the intensive care units and nurses' competence in mechanical ventilation and weaning practices.

Henneman, et al. (2002) also studied weaning decision-making from a collaborative viewpoint. They tested the effect of a collaborative weaning plan developed by a multidisciplinary team on the duration of ventilation time and ICU stay. Two hundred and two patients ventilated for more than three days were included in a pre and post quasi experimental study using a historical group. Data related to patient, staffing and organisational structure were also collected to investigate their effect on the implementation of the weaning plan.

The results revealed a significant reduction in length of stay and ventilation time but no differences between groups related to cost and incidence of complications. This study showed a significant positive effect of collaborative decision-making in the length of stay in ICU. However, more research is required in the field of collaborative decision-making in ICU settings, if the objective is to increase nurses' autonomous decision-making with an effect on patient care and organisational benefits.

#### 3.4.2 FACTORS THAT AFFECT CLINICAL DECISION-MAKING

Factors that affect nurses' clinical decision-making have been well described in recent quasi-experimental studies that compared junior and senior nurses' ability of critical thinking and decision-making (Giriot, 2000; Angel, et al., 2000; Botti, et al., 2003). These studies concluded that more advanced students may develop the ability to consider more information overall when making diagnostic judgments, which

signified that decision-making competence is affected by nurses' academic ability. Girot (2000) explained that clinical decision-making is enabled by exposure to the academic process, rather than to experience, because it develops the skill of synthesizing new information and knowledge and enables the diagnostic reasoning process.

Other factors that affect clinical decision-making are mentioned in studies about the use of research and evidence-based practice by clinicians. Evidence-based practice relies in part on the application of normative decision rules that in turn rely on clinicians making use of probabilities, both objective and subjective. However, nurses do not appear to revise probabilities or adjust diagnostic strategies for different base rates, even when qualitatively rare or common conditions are presented as decision tasks (Offredy, 2002).

The current demands for evidence-based practice necessitate research utilization as one element of the process of clinical decision-making. According to Rodgers (1994) the utilization of research includes the direct implementation of research findings into practice, the indirect use of research in creating new understanding and the incorporation of methods or tools of research into practice.

In support of the use of research when nurses make decisions, is mentioned a study by Thompson, et al. (2001) who focused on the examination of sources of information, which nurses find useful when they feel uncertain about making clinical decisions. Thompson, et al. (2001) used a cross-case analysis which involved qualitative interviews, observation, documentary audit and Q methodological modelling of shared subjectivities amongst nurses. One hundred and eighty nurses from three large acute hospitals in England were interviewed, 61 of them were also observed and 122 were involved in the Q modelling exercise in order to examine the real life clinical problems that nurses face and the information which they consider most helpful in shaping their responses to these decision challenges.

Thompson, et al. (2001) identified four perspectives on the perceived usefulness of research information sources; direction and guidance; a form of experiential knowledge; centrally supported experience-based messages for practice; and a blending of research technologies and experience. Sources which combined clinical expertise, experience and perceived research-based knowledge attracted the most use from charge nurses and nurse consultants. The authors highlighted that the medium through which research knowledge is delivered is what makes nurses more confident in accessing research information. This is more apparent in acute settings with well-developed information technology and development infrastructures, while in primary care nurses are more isolated from such sources of information.

Authors who have studied nurses' decision-making have focused on the impact of the clinical environment on clinical judgment and behaviour, but not specifically related to the mechanical ventilation or weaning practice. Bucknall (2003) and Hedberg and Sätterlund-Larsson (2004) used observational methods to gather data from 18 nurses (Bucknall, 2003) and 6 nurses (Hedberg and Sätterlund-Larsson, 2004), respectively. Content analysis revealed that patient situation, availability of resources and interpersonal relationships were environmental influences identified in Bucknall's (2003) study. These findings were consistent with a previous qualitative study by Bucknall (2000). Hedberg and Sätterlund-Larsson (2003) found that interruptions and work procedures affected both the process and the outcomes of nurses' decision-making. In both studies there was a significant risk of bias due to the investigators' involvement in data collection and analysis, but both studies demonstrated the need for further exploration of the environmental elements of clinical settings that challenge the nurse to develop strategies in decision-making to guarantee secure patient-care, and the need to test how these elements might improve the assessments and the outcomes of the patient delivery.

Mrayyan (2004) conducted a comparative survey in which she used a 42-item self-report questionnaire to examine 317 hospital nurses' autonomy in decision-making and the influence of nurse managers in the USA, Canada and the UK. Content

validity of the scale was established by an expert panel of ten nurses who found the scale satisfactory. Internal consistency of the scale items was measured and alpha coefficient was 0.66. The scale was revised again and piloted with 5 graduate nursing students and the revised scale had a reliability coefficient of 0.88 which was satisfactory for a newly established scale. Electronic data collection and statistical analysis produced findings which indicated that nurses had more autonomy over patient care decisions than over unit operation decisions and highlighted that education enhances autonomy. Limitations of the study were the convenience sample which limits the value of the study and the fact that web-based research is reported to have a lower response rate than traditional mailed surveys (Duffy, 2002). However, the author made useful recommendations about enhancing staff nurses' autonomy by exploring in more depth the role of the nurse manager and examining the barriers to autonomy that nurses face in relation to unit operational decisions and what actions nurse managers could take to increase nurses' participation in these decisions.

A comparative study was conducted by Bakalis, et al. (2003) to identify factors that best predicted clinical decision-making in acute phase of myocardial infarction of 60 coronary nurses in Greece and England. Q methodology or Q-sort (clinical decision-making cards, CDM cards) was chosen to measure quality clinical decisions between nurses and a 14-item questionnaire was constructed to identify the factors that best predicted clinical decision-making. Six hospitals from both countries were randomly selected and the instrument was piloted to test reliability and validity.

The results revealed that the quality of nurses' decision-making in the acute phase of Myocardial Infarction in Greece and England was similar, but in the recovery phase English nurses made more autonomous decisions than Greek. The factors that were identified to influence their decisions were the bio-medical model of patient care, the pre-registration education, the continuing education, the academic qualifications, the clinical experience and clinical guidelines. The possible limitations of the study were the small sample size and the cultural bias.

Research on clinical decision-making has moved recently to the investigation of teamwork. Many authors have studied the collaborative decision-making process in different clinical settings and different contents (Higgins, 1998, Holmes-Rovner, et al., 2000, Cioffi, 2000, Henneman, et al., 2002, Dalton, 2003).

Nurses' perceptions of the collaborative decision-making were explored by Higgins (1998). Based on the theoretical framework of the Information Processing Theory, she conducted a prospective correlational study to investigate nurses' perceptions about the nurse-physician collaborative decision-making on transferring patients in a Medical ICU of a teaching hospital in Pennsylvania. A convenience sample of 175 patient transfer decisions was used to explore 42 nurses' perceptions via a questionnaire which was distributed to them to respond to questions relating to patients' transfer decisions. Organisational and managerial outcomes were measured. Data were collected by using an adapted version of the Decision about Transfer Scale (DAT) developed by Baggs (1990), which measures nurses' perceptions about the nurse-physician patient transfer decisions, task complexity and process satisfaction. Descriptive statistics were used to analyse the data and hierarchical logistic regression and chi-square to test the hypotheses made.

The results revealed that nurses' perceptions of collaboration were not a significant predictor of patients' outcomes and their experience and decision task complexity did not influence their contribution to the collaborative decision-making. Also, a positive relationship was found between nurses' perceptions and their satisfaction with the collaborative decision-making process. However, the nature of the study's correlational design, although prospective, and the use of a low validity measure of collaboration (DAT) were limitations of the study, and suggested further research in the area strengthened with a design which will allow for a more definitive assessment of the nurse-physician relationship in decision-making and patient outcomes.

The collaborative decision-making was employed in many clinical settings as a framework to explore nurses' decision-making. Characteristically, Cioffi (2000) interviewed 32 registered nurses about how they made decisions to call the Medical



Emergency Team (MET) for patients who required immediate medical intervention to prevent occurrence of cardiac arrest. The content analysis of transcribed interviews demonstrated that because nurses were uncertain about calling the MET they relied on collaborative decision-making. Many nurses recognised patient deterioration by using their gut feelings but did not feel confident to make decisions.

### 3.5 CONCLUSION

The review of the literature on clinical decision-making developed around the prescriptive and descriptive perspectives of studying decision-making and the various theories that explain how nurses make decisions or how they should make decisions. Clinical decision-making can be viewed as a rationalist process that involves collection of information, generation and testing of hypotheses in order to make a decision or as an inductive intuitive process that does not involve rationalisation. The concept attainment theory provides a thorough framework to examine how nurses use information and their knowledge to make clinical decisions.

On the other side of the decision-making spectrum, the hermeneutic paradigm supported by phenomenology acts interpretively to the study of nurses' decision-making offering a different viewpoint. The phenomenological perspective enables the consideration of the social environment and clinical culture to understand nurses' decisions and clinical behaviour. A variety of data collection and analysis methods can be used in the study of clinical decision-making depending on the nature and aim of the study. The literature, though, advocates the incorporation of various methods to study clinical decisions to achieve a robust and vigorous study design.

Finally, the study of decision-making in relation to mechanical ventilation and weaning demonstrated a lack of knowledge on how nurses, as decision-makers, use their knowledge to make decisions during this complicated process given the existence of the clinical guidelines and weaning protocols, which aim to facilitate decision-making and increase nurses' role. Whilst protocols address the decision task and assist the decision-maker, the third component of clinical decision-making, the clinical environment, should be also considered in order to obtain a holistic understanding of the weaning decision-making. The current literature has failed to involve the clinical environment when examining nurses' clinical decisions. This study aimed to examine nurses' cognitive process during ventilation weaning decision-making within the natural environment of critical care and to demonstrate the impact of elements of the decision-making environment on nurses' clinical

behaviour. The following chapter provides the methodological approach for this study.

# CHAPTER FOUR

## METHODOLOGY

## **CHAPTER FOUR**

### **METHODOLOGY**

#### **4.0 INTRODUCTION**

Following a review of the literature on clinical decision-making and on the complex process of mechanical ventilation and its discontinuation, a gap in knowledge was identified regarding nurses' involvement in decision-making during the weaning process and the factors that impact on this process. This chapter provides a detailed and justified account of the methodological approach used to answer the research questions generated from the literature review.

The chapter begins with stating the importance of the study, identifying the overall and specific aims of the study and outlining the research questions. It provides a justification for the comparative character of the study and continues with analyzing the theoretical framework on which analysis relied. The research design selected was tested in a small pilot study prior to entering the main field, so as to assess the effectiveness of the data collection methods to extrapolate the most valid data. Discussion follows on the methods applied to increase the trustworthiness of the study, on the language issues and on the ethical considerations for conducting this comparative study.

## **4.1 APPROACH TO THE STUDY**

### **4.1.1 IMPORTANCE OF THE STUDY**

Clinical decision-making is an intrinsic part of clinical practice, as clinicians have to decide what data to collect, interpret the information, plan and administer interventions and finally evaluate the outcomes of patient care. Bucknall and Thomas (1995) argued that critical care is different from other areas of nursing, because critical care patients are seriously ill and frequently highly unstable. Their rapidly changing health status demands intelligent and quick decisions from nurses in order to deliver expert individualized care in a highly complex environment. The decision-making process becomes particularly complicated when managing long-term ventilated patients, who, due to the severity of the respiratory failure, have difficulty in liberating from mechanical ventilation. Moreover, Mitchell (1984) highlighted that technology, such as monitors and ventilators, can confuse interpretation with the multiplication of data delivered, therefore, making decision-making more intricate.

My experience, as a critical care nurse working as part of a multidisciplinary team in a general ICU, made obvious that mechanical ventilation and its weaning is a highly demanding task that requires increased knowledge of the respiratory pathophysiology and the principles of mechanical ventilation, as well as skills in identifying the patients' appropriateness to wean, and in making decisions under uncertainty. Nurses are the clinicians who spend their working time by the bed space caring for critically ill patients, and so, are in the position to recognise promptly the patients' responses to treatments. Consequently, their input during the process of discontinuing mechanical ventilation is valuable to inform the process of ventilatory weaning decision-making.

The recent introduction of weaning protocols in intensive care have served the purpose of providing a standardised approach to weaning practices and of facilitating nurses in having a vigorous role in the process. However, nurses' input during the weaning process still remains limited. The literature review highlighted that there is minimal research on nurses' clinical decision-making when weaning critically ill

patients from mechanical ventilation. Understanding their decision-making in real clinical practice can give insight into how they use their knowledge to make judgments and decisions when reducing mechanical ventilatory support. This knowledge can improve not only nurses' ability to make high-quality decisions that promote the care of critically ill patients, but can also facilitate training and skill acquisition of junior critical care nurses.

Nevertheless, clinical decision-making is a complex function affected not only by the nature of the task and the skills of the decision-maker, but also by the characteristics of the decision-making environment. There is little knowledge on the factors of the decision environment and their impact on the clinical decisions in the critical care setting and in particular in relation to the management of the ventilated patient.

This study aimed to investigate the intricate phenomenon of weaning from mechanical ventilation within the theoretical perspective of clinical decision-making. It aimed to provide a clear standpoint on clinical judgment and decision-making in the very demanding multidisciplinary environment of intensive care, by analyzing nurses' decisions and behaviour within the existing socio-cultural characteristics of the decision-making environment. One way to explore the complex decision-making process of nurses when weaning mechanically ventilated patients, taking into account the cultural context of intensive care, was the use of a design that would incorporate the qualitative components of observation, conversations and written material. Before starting the exploration of this phenomenon, the aims and research questions of the study are displayed in the next section.

#### 4.1.2 AIMS OF THE STUDY

This study was conducted to understand the complex and challenging process of discontinuing mechanical ventilation of critically ill patients within the socio-cultural environment of intensive care, in order to identify ways to improve future practice and decision-making. Given the introduction of weaning protocols, it was also

eminent to identify their tangible role in weaning decision-making. The specific aims of the study were: first, to analyse nurses' thinking process when assessing and managing long-term weaning patients and to illustrate how their thinking was interpreted into complex ventilatory weaning decisions during their clinical practice; second, to demonstrate how these decisions were interpreted into behavioural tasks that illustrated the weaning approaches followed; finally, to explore the socio-cultural factors that influenced nurses' input in decision-making when weaning long-term ventilated patients.

Since the study aimed to address the reality of clinical decision-making in the field of weaning long-term ventilated patients in intensive care, the Naturalistic Decision Making (NDM) perspective, which was described in chapter three (section 3.3.2) offered a theoretical standpoint. The NDM approach supports the exploration of the cognitive processes underlying the behavioural components of a decision task by using knowledge elicitation and representation techniques (section 3.3.3).

Moreover, the concept attainment theory (section 3.2) offered an appropriate structure for conceptualising the decision tasks during ventilatory weaning and their interpretation into clinical practice. The research questions were formed to meet the aims of the study and more focused questions emerged in line with the concept attainment theory. These are organised in the following section.

#### 4.1.3 RESEARCH QUESTIONS

The research questions that initiated the conduct of this study and more focused questions that developed are displayed below.

Preliminary questions:

1. What decisions did critical care nurses make regarding the weaning of long-term ventilated patients, in different settings?



2. How did critical care nurses form these decisions, in different clinical settings?

3. What is the role of the weaning protocol in the decisions made regarding the weaning of long-term ventilated patients, in different settings?

4. What factors influenced nurses' decision-making and clinical behaviour during the management of weaning long-term ventilated patients, in different settings?

To explore how nurses informed their decisions and answer the second question, more focused questions developed, in line with the concept attainment theory:

5. What concepts were developed by the nurses, in different settings, when assessing and managing the weaning of long-term ventilated patients?

6. How did nurses, in different settings, link the concepts attained with the attributes that described these concepts?

7. How did nurses, in different settings, validate the attainment of the concepts?

8. What decision-making strategies did nurses, in different settings, use to attain these concepts?

9. How these decision strategies were interpreted into clinical behaviour that described the weaning approaches followed, in different settings?

One more question was added after a preliminary visit in the settings:

10. What were nurses' and doctors' perceptions about teamwork, in different settings?

The word '*different settings*' in the questions above was added in order to understand the impact of the characteristics of the clinical environment and different socio-cultural factors on nurses' decision-making and clinical behaviour. Therefore, I decided to conduct a comparative study between two countries with differences in

the culture of the clinical environment. More details about the selection of the settings and the countries are presented in the next section.

#### 4.1.4 THE CLINICAL SETTINGS

##### 4.1.4.1 Similarities and differences

I aimed to conduct this study in two different settings so as to explore the characteristics of the clinical environment and their impact on nurses' behaviour and decision-making. The selection of the settings was based on two main characteristics: a. general ICU receiving a variety of medical cases that require mechanical ventilation; b. an existing implemented weaning protocol to guide practice when discontinuing mechanical ventilation.

My professional experience in working in intensive care in Greece and Scotland facilitated the selection of the settings, because I identified two settings which fulfilled the main criteria, mentioned above, but also had important differences in the philosophy of health care, in nurses' educational preparation and in the organisational structure and culture. The study took place in an ICU in a NHS University Division Hospital in Scotland and an ICU in a NHS University Division Hospital in Greece.

The reason for comparing Greek and Scottish nurses in making clinical decisions was multifactorial. First, both countries are European, so they abide by the same European Union regulations for patient care and they both have a National Health System. In terms of nursing recruitment, there is a shortage of nursing staff in both countries, but more excessively in Greece. Finally, they have similar hierarchy of nursing staff, although in Greece the role of nurse consultant does not exist.

However, there are differences in the philosophy of health care and the professional regulations imposed by the statutory bodies of nursing. To start with, nursing philosophy in Greece is based on respect for the inherent individuality of every

patient. In Greece, 50% of health services are concentrated in Athens, the capital of Greece, the public service is not satisfactory, and so the rural population is forced either to go to cities or choose the private sector. Moreover, there is a lack of nursing staff to cover the needed posts for a safe provision of care (Kotsabasaki, 1998).

Hospitals in Greece are physician-led and nursing is seen as a dependent profession, where the nurse is obliged to act as the eyes and ears of the doctors, carry out instructions and faithfully report back (Bakalis, et al., 2003). Despite the fact that the professional status of nursing has received formal recognition by the Legislative Decree 683/1948, nursing still does not enjoy high prestige as an occupation and the social status of a nurse is very low (Lanara, 1998; Sapountzi-Krepia, 2002).

In Greece, by Presidential Law (1989) qualified nurses with their own responsibility have the right to practise in specific areas. Nursing is dependent on medicine for knowledge, the nursing curriculum is biomedical and the Code of Professional Practice does not stress nurses' autonomy (Kotsabasaki, 1998). Nurses' degree of autonomy is low and they are expected to work to the directives of doctors. This was apparent during my working experience in Greece, but is also supported by Papathanassoglou, et al. (2005), who revealed a moderate autonomy of critical care nurses in technical tasks and a low decisional autonomy. Nurses' licence in Greece is for life and there is no continuing education. The Greek Law does not regulate continuing education; only ad hoc programs and seminars are organised in most hospitals and other health services for nurses.

In contrast, the philosophy of care in Britain supports a more holistic approach in delivering care and improving quality of life and invites nurses to participate in the provision of holistic care (Salvage, 1991). The Department of Health and Social Security (DHSS, 1990) supports that health services were developed to help health authorities monitor and plan delivery of services nation-wide. The nursing curriculum is based on holistic care and health promotion, whereas the Scope of Professional Practice (UKCC, 1996) emphasizes on individual professional accountability and clinical decision-making (Bowler and Mallik, 1998). Registered

nurses are prepared to apply knowledge and skills in order to make autonomous decisions for which they are responsible. The updated Code of Professional Practice for Britain states that:

*As a professional, you are personally accountable for actions and omissions in your practice, and must always be able to justify your decisions. You must always act lawfully, whether those laws relate to your professional practice or personal life. Failure to comply with this code may bring your fitness to practise into question and endanger your registration. [Code of Professional Practice, NMC, 2002]*

In Britain, the idea of a ‘*nursing specific knowledge*’ is part of the service ‘*culture*’ and is given explicit recognition in the establishment of nurses’ roles such as the nurse specialist and nurse consultant posts (Bowler and Mallik, 1998). There are structures around education and continuous professional training, accountability and also research, which recognise this nursing knowledge and expertise. British nurses are responsible for their personal development and they have to prove their competencies by renewing their Nursing and Midwifery Council (NMC) registration every 3 years. The British Law through the statutory NMC body regulates continuing education, and nursing registration depends on demonstrating professional development during the 3-year periodic registration.

#### 4.1.5 CHARACTERISTICS OF THE SETTINGS

The university hospital in Greece and the university hospital in Scotland are the two settings where this comparative study took place. The selection criteria for the two settings were a general ICU, where patients, who have difficulty in breathing spontaneously, are admitted, regardless of the underlying condition. In both settings the case mix is similar, as there are patients admitted with respiratory failure, surgical, medical and trauma patients, as well as emergency and planned referrals. Both wards do not routinely manage post-cardiac surgery patients or isolated neurotraumas.

#### 4.1.5.1 Intensive Care Unit in Greece

The setting at the University Division General Hospital in Greece was a 12-bedded ICU on the first floor of the main building of the hospital. The L-shaped unit had 10 bed spaces in an open plan area and two isolation rooms, called cubicles, but only one of them was in use. The other cubicle was used as storage for the equipment, but it opened in emergency needs for an empty bed. There were rooms for storing and preparing medication, a room where the blood gas machine was located and a laboratory room. There was also the staff room where nurses and doctors rested and the doctors' office. It should be mentioned that the hospital did not have a separate High Dependency Unit (HDU) due to lack of resources. Therefore, patients who required high dependency care were also admitted in ICU.

In the Greek setting, 8-hour shifts were organised within 24 hours, from 7 am to 3 pm, from 3 pm to 11 pm and from 11 pm to 7 am the next morning. The Greek ICU was staffed with 39 Full Time Equivalent (FTE) permanent staff, of which thirty-three were registered nurses, one was the unit clinical nurse manager and five were Health Care Assistants (HCAs). All staff worked full-time (37.5 hours/weekly according to the European Directives) and there was no option to work part-time hours. Nurses rotated within a week. An example of Greek nurses' rotation in a week is displayed in table 4.1.

| Greek Intensive Care Unit |         |          |                            |          |        |          |        |
|---------------------------|---------|----------|----------------------------|----------|--------|----------|--------|
| Day                       | Monday  | Tuesday  | Wednesday                  | Thursday | Friday | Saturday | Sunday |
| Nurse                     | 7am-3pm | 3pm-11pm | 7am-3pm<br>and<br>11pm-7am | 11pm-7am | off    | off      | off    |

**Table 4.1 Greek nurses' shift rotation**

There were 17 doctors employed in the unit; nine consultants, five senior registrars and three junior doctors. Senior registrars and consultants were permanent and rotated weekly in their clinical duty. Junior doctors were not permanent since their

speciality training lasted for four to five months. In their weekly clinical duty, they rotated every four days.

On a day shift, there were six staff nurses, two HCAs and the clinical nurse manager on duty. On an evening shift, there were five staff nurses and one HCA on duty, while on a night shift there were four staff nurses on duty. During the weekend, the clinical nurse manager was not on duty, but a senior nurse took charge of the ward and also looked after a patient. The nurse: patient and doctor: patient ratios for each shift are displayed in table 4.3. On the weekends the ratio remained the same.

#### 4.1.5.2 Intensive Care Unit in Scotland

The setting in Scotland was an 18-bedded mixed ICU and HDU in an open plan area, where patients were admitted for invasive and non-invasive ventilation. There were four isolation rooms, which were all in use. There was a big storage area, a clean room and a laboratory room. Within the clinical area, there were two consultation rooms, whereas the doctors' office, the sisters' office and the rest room were outside the clinical area.

In the Scottish setting, there were 12-hour shifts, from 7.30 am to 7.30 pm, and from 7.30 pm to 7.30 am the next morning. The Scottish ward was staffed with 180 FTE registered nurses and 10 HCA. Thirty per cent of staff nurses worked part-time. On each shift, there were 18 nurses, the nurse in charge and two HCAs. The clinical role of a '*runner*' related to nurses who were not allocated a patient to look after but provided assistance to their colleagues. There were two runners on each shift, whereas the nurse in charge coordinated the shift. An important element of the workforce was the possibility to cover lack of staff with agency or bank nurses, who were not permanent members of staff. There was not such a possibility in the Greek setting.

Scottish nurses also worked 37.5 hours weekly and rotated in thirteen shifts per month. An example of Scottish nurses' rotation is illustrated below (Table 4.2).

| Scottish Intensive Care Unit |               |               |                |          |        |          |        |
|------------------------------|---------------|---------------|----------------|----------|--------|----------|--------|
| Day                          | Monday        | Tuesday       | Wednesday      | Thursday | Friday | Saturday | Sunday |
| Nurse                        | 7.30am-7.30pm | 7.30am-7.30pm | 7.30pm-7.30 am | off      | off    | off      | off    |

**Table 4.2 Scottish nurses' shift rotation**

In this ward, there were employed 40 medical staff, 15 consultants and 15 senior registrars. The registrars rotated every six or twelve months, whereas the consultants had a permanent post. There were also junior doctors who specialized in medicine, anaesthesia or critical care and were also part of the medical workforce, but rotated every three to four months. Nurse: patient and doctor: patient ratios are displayed in table 4.3.

| Greek Intensive Care Unit |                     |                      | Scottish Intensive Care Unit |                     |                      |
|---------------------------|---------------------|----------------------|------------------------------|---------------------|----------------------|
| Shift                     | Nurse:Patient ratio | Doctor:Patient ratio | Shift                        | Nurse:Patient ratio | Doctor:Patient ratio |
| 7am – 3pm                 | 1: 2                | 1.5: 1               | 7.30 am – 7.30 pm            | 1:1                 | 1:1.8                |
| 3pm – 11pm                | 1: 2.2              | 1: 6                 | 7.30 pm – 7.30 am            | 1:1                 | 1:9                  |
| 11pm – 7am                | 1: 2.75             | 1: 6                 |                              |                     |                      |

**Table 4.3 Nurse: patient ratio and doctor: patient ratio in both settings**

Having explained the aims of the study and the research questions that emerged from the literature review, and having described the two settings that this comparative study took place in, the next section provides a detailed account of the methodology used to collect and analyse the data, so as to meet the aims of the study.

## 4.2 THE ETHNOGRAPHIC APPROACH

This study aimed to investigate in-depth nurses' clinical decision-making during the weaning process of long-term ventilated patients and to explore the factors that impact on this process and form clinical behaviour. To achieve this aim, it was important to apprehend the reality of decision-making in the natural environment as intangible mental constructions held by nurses based on their experience and culture (Guba and Lincoln, 1995; Bryman, 2001). Constructivism as an ontological position allowed this understanding and permitted a comparison of different cultures in weaning from mechanical ventilation practice. Since interpretation of nurses' clinical behaviour was critical for obtaining a thorough understanding of their decision-making, interpretivism appeared to be the appropriate epistemological position to meet the aims of this study (Bryman, 2001).

Valerie Janesick in Denzin and Lincoln (1994; p. 210) supported that ethnography as a qualitative research approach can offer this in-depth investigation of the phenomenon, and described qualitative research as a choreography with which the researcher wants to answer the question '*What do I want to know with this study?*'. Janesick used the example of a dancer allegorically to demonstrate that qualitative research is made up of three stages.

First, the warm up stage, when design decisions are made at the beginning of the study; it incorporates decisions on the questions that guide the study, the selection of site and participants, access issues and consent, and selection of the appropriate research strategies and theory that formulate the study.

The second phase is the workout stage of the dancer/researcher, when design decisions about data collection and data analysis are made throughout the study. This is where a pilot study before entering the main data collection period is valid, because it can offer insight into the perspectives of the participants in the study, the relationships regarding the structure, occurrence and distribution of events over time and look for conflicting points of evidence or points of tension that do not fit in the



study. The description of the pilot phase for this ethnographic study is offered in section 4.3.4.

The third phase is the cool down phase, when additional design decisions are made. These decisions relate to the refinement of concepts that developed throughout the data collection and analysis, which will be used to construct theory that explains the phenomenon of the study, and which will be reported. A series of decisions were made at the beginning, the middle and the end of this study to most comprehensively and thoroughly understand and meet the challenges of conducting research in the real setting in order to extract the most valuable data that answered the research questions.

The intent of this study was to immerse in the ongoing social activities of critical care nurses and to understand the human elements that interact in the decision-making system and influence patient care. An understanding of behaviour and meaning is particularly relevant to health and illness as it facilitates the understanding of health values, beliefs and meaning systems (Morse and Field, 1995; Streubert and Carpenter, 1999). Ethnography offered the methodological approach to achieve the aims of the study, because it allowed the close observation and engagement with the critical care nurses and their weaning practices.

Although a historic narration of the development of ethnography as a research method is beyond the purpose of this thesis, it is important to mention that ethnography originated from the need to recognise the cultural differences of people who inhabited different cultural worlds in different periods of the Western history (Spradley, 1980; Atkinson and Hammersley, 1994). Despite the fact that ethnography, historically, belonged to the interpretive or hermeneutic paradigm of research rather than the positivist, Atkinson and Hammersley (1994) disagreed by supporting that there is a diversity of ideas about the nature of methods in natural science to understand human social life.

Ethnography has its origin in the naturalistic tradition of anthropological studies of the late 19th and early 20th century (Spradley, 1980). The two key phases of the development of ethnography in the twentieth century, the work of the founders of modern anthropology, Boas, Malinowski and Radcliffe-Brown, and the work of the Chicago school of sociology in 1960, reflect the tension that exists in adopting or rejecting a scientific model based on natural science. The lack of a single philosophical or theoretical orientation that can support ethnography does not deprive it from its effectiveness and appropriateness for exploring human behaviour in its cultural context. On the contrary, as a methodology, it can inform the selection and use of research methods and lead to the desired outcomes (Crotty, 1998). Therefore, researchers have adopted different approaches of ethnographic practice to study different areas (Atkinson and Hammersley, 1994).

In the nursing field, Leininger (1985) was a pioneer with her ethno-nursing research method focusing on nursing phenomena from a cross-cultural perspective (Germain, 2001). Ethnography provided nurses with the opportunity to explore the socio-cultural nature of clinical settings and to ask questions relevant to nursing practice. Leininger defined ethnography as:

*The systematic process of observing, detailing, describing, documenting, and analyzing the lifeway or particular patterns of a culture in order to grasp the lifeway or patterns of the people in their familiar environment. (Leininger, 1985, p.35)*

For this study, ethnography allowed me to be close to nurses, to observe their behaviour and clinical judgment when making decisions about the patients' ventilation in their natural environment and to uncover aspects of the organisational culture that impacted on the decision-making process. Carroll and Johnson (1990) asserted that naturalistic observation allows for monitoring of information that subjects consider and the order in which it is acquired, at which point researchers can make assumptions of the cognitive processes underlying the decisions being made.

Another advantage of ethnography is that it can offer a thorough description of the contextual circumstances of the phenomenon under study, through reporting of

fieldwork. Contextualised fieldnotes can be considered a holistic way of studying a phenomenon, in this case nurses' decision-making during the weaning process from mechanical ventilation, because they offer a detailed description of the interrelated elements and their link with the phenomenon under study. In accordance with those principles, a detailed description of the two settings where this ethnographic study took place was presented in sections 4.1.4 and 4.1.5, in which the professional and institutional policy of each hospital was explained. The understanding of the contextual elements of each setting and their impact in nurses' clinical decision-making is completed in chapters seven and eight.

The difficulty in applying ethnography in nursing, from an insider's point of view, is that nurse researchers always have a familiarity with the field, which has been criticised for the trustworthiness of the data collected (Wolcott, 1999). The research account has to mirror the dialectical process of interactions between the participants and the researcher and it has to show how data were generated. A few observational studies have described clinicians' behaviour in different clinical situations and have proved that fieldwork can be used effectively to describe and interpret in depth human behaviour and perceptions in relation to patient care (Ferrell, et al., 1991; Mardegan, 1997; Aitken and Mardegan, 2000; Aitken, 2003).

For this study, the risk of my interference, as an active critical care clinician, in the collection and interpretation of data was high, jeopardising the trustworthiness of the study. Therefore, a need emerged to explore my own beliefs when caring for weaning patients and to identify my role in research. Reflexivity is an indispensable principle of ethnography and is understood by Wasserfall (1997, p. 151) as '*a position of a certain kind of praxis where there is a continuous checking on the accomplishment of understanding*'. I carefully monitored my own subjectivity, my specific knowledge of the subject under study and the effect of my own beliefs and behaviour as a critical care nurse on the participants and the interpretation of the data by conducting an auto-ethnographic exercise prior to the collection of data for the main study. The auto-ethnographic account is presented in chapter five.

The next section describes the research process, the issues for gaining access, the methods used to extrapolate the most valuable data that informed the study and the pilot study prior to entering the main field.

## 4.3 THE RESEARCH PROCESS

### 4.3.1 GAINING ACCESS

Negotiating access to both ICUs before entering the fields was mandatory. Gaining access in the Greek setting was easier than in the Scottish setting, due to the different processes of the Ethics Committees.

The first step to negotiate access to the Scottish setting was to contact the Medical Director of the ICU in September 2006. Prior to this meeting, I e-mailed him explaining the purpose of the meeting and sent the research proposal of the study. He, very enthusiastically, accepted to support and to facilitate this initiative after commenting that it was an interesting study that could inform current clinical practice.

The second step was to apply to the local Ethics Committee for qualitative studies in July 2007. The Committee granted the ethical approval in October 2007, after requesting some clarifications of the research design and suggesting some alterations of the participant information sheet. More details about the ethical aspects of the study are discussed at the end of the chapter (section 4.8).

Having had the ethical approval by the ethics committee (Appendix 4.4a), I arranged a meeting with the Nursing Manager of Critical Care in order to explain the steps of the study and ask for her permission to talk to the nurses prior to starting the data collection. It was arranged that the Manager as well as the charge nurses of the unit would facilitate the process and inform the staff about the study, before starting fieldwork. An information package, which included the invitation to participate in the study, the participant information sheet with details about the study and the consent form, as well as a short questionnaire on each participant's demographic characteristics, was prepared and was made available to potential participants (Appendices 4.1, 4.2, 4.3). A box with the designation '*please take one*' and a second box with the designation '*returned envelopes*' were placed in the staff room to increase the chances of more nurses being informed about the study. Moreover, I

attached a copy of the information sheet about the study in the staff communication book.

Fieldwork in the Scottish setting took place between November 2007 and March 2008. Follow-up interviews took place between October 2008 and January 2009, because it was not possible to carry them out earlier since I needed to travel to Greece to conduct the comparative fieldwork.

Negotiating access in the Greek setting was easier. The first step was to contact the Medical Director of the ICU in September 2007, who agreed to meet me after I had sent him the research proposal of the study. He expressed his interest in facilitating the study, because he was very keen in research. He advised me to write a formal letter requesting access to the ICU for research purposes and send it to the ethics committee of the hospital along with the research proposal translated in Greek. In October 2007, a month after I had sent the letter of request, I received a positive answer to access the setting for fieldwork.

Following the positive answer from the ethics committee (Appendix 4.4b), I met with the Nurse Director of the Greek hospital to inform her about the practicalities of the research project. The Nurse Director introduced me to the Clinical Nurse Manager of the ICU. The Clinical Nurse Manager agreed to facilitate the research process by informing the nurses about the study. Information leaflets about the study were administered to all nurses for this purpose. Data collection in the Greek setting started in April 2008 and ended in August 2008.

#### 4.3.2 SELECTION OF PARTICIPANTS

Nurses, medical staff and physiotherapists were invited to participate to the study. Participation was voluntary. Nurses, with a range of experience, who were observed during clinical practice were selected based on the criteria below.

- Registered nurse
- Having a diploma or degree in Nursing
- Having experience in critical care of at least one year
- Working in the particular ICU for at least one year
- Working at least two days per week
- Involved in the care of ventilated patients and their weaning process

**Table 4.4 Selection criteria of participant nurses**

Selecting nurses with a range of experience was important in order to understand whether the difference in experience had an impact on how nurses made decisions regarding the patients' weaning process. It was also expected that nurses with experience of working in the particular ICU for more than one year would have integrated in the working environment, so as to understand their behaviour when interacting with colleagues. The criteria were adopted according to Benner's model of skill acquisition, which describes that nurses pass through five levels of development; Novice, Advanced Beginner, Competent, Proficient and Expert (Benner, et al., 1984, 1992, 1996).

Medical staff with a range of experience and physiotherapists specialised in critical care were also approached to participate to the study and express their perceptions about weaning and clinical decision-making within their working environment. Similarly, doctors and physiotherapists participation was voluntary.

#### 4.3.3 DATA COLLECTION METHODS

This section provides an account of the data collection methods that were initially selected to describe the phenomenon of decision-making during the weaning process of critically ill patients. These included participant observation, think aloud interviews with the nurse participants followed by explanatory interviews and semi-

structured interviews with nurses, doctors and physiotherapists involved in the weaning process.

#### 4.3.3.1 Participant observation

In a practice-based profession such as nursing, observation is an important method for collecting information and can provide valuable details of the human behaviour. Adler and Adler (1994) remind us that, observation has served as the basic source of human knowledge in the study of social and natural phenomena. The nature of the nursing profession imposes nurses to be skilled observers to provide accurate and precise information on the patient's condition. Clearly, the purpose of observations in nursing practice differs from that in nursing research, because nurses observe to attend to the needs of the patient, whereas researchers conduct observations for the purpose of answering research questions. Nevertheless, this skill of observing and collecting precise information can be used to collect research data that focus not only on the process of care but also on interactions and human behaviour within the working environment.

As a critical care nurse, I used this integrated skill as a research tool for this study. The observation method in the natural setting is a reasonable reflection of the link between acquisition and use of information for ongoing decision-making (Parahoo, 2006) with the scope to make inferences of the participants' thinking processes. Observation is suited for studying the behaviour of health professionals, for investigating non-verbal activities, interactions and communication and can give insight into the context of the natural setting where it occurs. Moreover, in natural settings, situations and interactions also reveal data, and it is possible for the researcher to be an interpreter or '*knower*' of such data as well as a participant observer. When observation is used in combination with other methods, such as interviews and document analysis, it can provide richer data on the topic under investigation.



Participant observation was selected as the primary data collection method. The first stage of the study was to observe both settings for a period of one month each to preliminarily understand the site itself and gather information on the context of human behaviours, the types of behaviour, staff interactions, the kind of decisions made, by whom, and in which cases, and understand how information travelled among the staff.

After having spent some time of general observation in both settings, I selected a number of specific cases of difficult to wean patients to observe and compare the dynamics of decision-making in different circumstances. Patient cases were selected based on the criteria below.

- Patients mechanically ventilated for more than 24 hours
- Patients who have failed to wean within 4 days of mechanical ventilation
- Medical or surgical patients in need of mechanical ventilation due to respiratory failure caused by pneumonia.
- Patients with exacerbation of Chronic Obstructive Pulmonary Disease (COPD) and type II respiratory failure due to pneumonia and/or
- Patients with type I respiratory failure due to pneumonia

**Table 4.5 Selection criteria for patient cases**

Respiratory failure (RF) was used to describe clinical conditions, which constituted inability of the patient's respiratory system to provide adequate gas flow and gas exchange in the lungs. Many clinical conditions can induce respiratory failure, but this study focused on respiratory failure caused by pneumonia. Respiratory failure is classified as type I and type II. Type I RF is defined as reduced oxygen in the arterial blood, or else hypoxemia, but without increase of the level of carbon dioxide in the arterial blood, or else hypercapnia. Type II RF is defined by the presence of hypercapnia (Tobin, 1994). The latter is usually observed in patients with exacerbation of COPD due to pneumonia. Those patients were also eligible for this study. Patients who were ventilated for more than 4 days were considered as long-

term ventilated patients and were selected for this study. Finally, effort was made to select similar cases in both settings.

Each nurse who cared for the particular weaning patient was observed for 2 to 4 hours during practice. Moreover, interactions among staff during handover and ward rounds were also observed.

#### 4.3.3.2 Think aloud technique

Having selected the patient cases, nurses were observed when caring for the specific weaning patients during their shift on a daily basis. During observation nurses were asked to think aloud when managing the patient's breathing. A microphone was attached to the participant and a tape recorder was used to record while verbalising their thoughts. Participants were given the option to think aloud throughout all the care they provided within the observation period or to think aloud only when managing the patient's ventilation and weaning. It was emphasized to the participants that they did not need to provide any explanation for their thinking. This was the purpose of the follow-up interviews, so thinking that was illogical or disjointed could be explained at that time.

The purpose for using the think aloud technique was to facilitate the access into nurses' minds so as to extract more in depth information of their cognition when managing the patients' weaning process. According to Aitken (2003), think aloud can also reveal information in relation to inaction decisions, since nurses articulate their thoughts while monitoring the patient. Such cases occurred when the nurses were observing the monitor or the ventilator and did not articulate their thoughts. In such case, I prompted the nurses to talk about their thoughts by asking them '*what are you thinking right now?*'

#### 4.3.3.3 Follow-up interviews from think aloud

As the objective of the study was to explore and examine feelings and behaviour, interviewing is the best approach for data collection. Arksey and Knight (1999, p.

32) comment that *'interviewing is a powerful way of helping people to make explicit things that have hitherto been implicit to articulate their tacit perceptions, feelings and understandings'*. Unstructured or non-directed interviews offer the possibility to the interviewee to express his or her experiences about the topic under investigation, while the interviewer facilitates the flow of information with as little interruption as possible (Parahoo, 2006).

Therefore, nurses who participated in the think aloud session were interviewed further in order to identify issues of the decision-making specifically related to individual incidents of weaning, to understand how these decisions were made, what they were based on, what factors influenced staff to make these decisions, and how influential nurses felt when it came to decision-making. The follow-up interviews were organised two or three days after the think aloud phase or as soon as the nurse was on duty after the observation period. The nurse was given the think aloud transcript from the first phase of data collection and was asked to give justifications of the decisions made during the management of the patient's ventilation and weaning. The interviews were semi-structured focusing on the processes outlined in the think aloud phase and lasted on average for thirty to sixty minutes. Questions were asked to clarify aspects of care that were not understood or interpreted with the correct meaning. Interviews were tape recorded as well to facilitate the analysis of data.

#### 4.3.3.4 Complementary semi-structured interviews

The final stage of the study was to conduct semi-structured interviews with the clinicians who were involved in the care of weaning patients, in order to explore their views on the practice of weaning given the existence of a weaning protocol, the role of the weaning protocol and their perceptions regarding teamwork in intensive care and its influence on decision-making. Nurses, doctors and physiotherapists were encouraged to participate and elaborate on the above issues and provide ideas that could be used to improve weaning practice. The purpose of those interviews was to

provide a more objective interpretation of clinical behaviour during weaning practice compared to my subjective view derived from participant observation.

The interview guide is presented in Appendix 4.5. In the Scottish ICU, 16 nurses, 3 doctors and 2 physiotherapists accepted to be interviewed, whereas in the Greek ICU, 17 nurses, 5 doctors and 1 physiotherapist were interviewed. The interviews were conducted in the working environment and when the participant was available. The interviews lasted for 30 to 60 minutes and were recorded. The selection criteria for interviewing nurses were the same as those selected for the think aloud section of data collection (table 4.4, section 4.3.2). Care was taken to select doctors with a range of clinical experience (Appendix 4.6).

#### 4.3.4 ASSESSING THE RESEARCH PLAN

In order to assess the practicalities of using the think aloud technique when observing nurses during weaning management, a short pilot study was conducted before initiating the main data collection.

##### 4.3.4.1 The use of a pilot for an ethnographic study in intensive care

Qualitative researchers using a range of methods have become accustomed to criticisms of subjectivity in their work and increasingly, in a post-modern context, to accusations of triviality and relativism and are always challenged to prove the trustworthiness of their methods. In an effort to represent in a more detached manner the reality of nurses' decision-making and clinical behaviour when managing the patients' ventilation and weaning, there was a need to test the design of the study with a preliminary pilot study.

Many ethnographic researchers have validated their research approaches and have recognised the advantages of a pilot study, either implicitly by regretting a lack of preparation prior to entering the field (Hammersley, 1993) or explicitly by acknowledging the conduct of fieldwork in a relatively undocumented and possibly

haphazard fashion (Delamont, 1993). Some researchers have explicitly chosen to refine and develop research instruments and assess degrees of observer bias in the conduct of a pilot (King, 1993; Gillham, 2000). Others have used the experience of a pilot to frame questions or collect background information and adapt a research approach (Ball, 1993; Fuller, 1993; Hammersley, 1993).

For this study, the pilot study had various aims. First, it aimed to familiarise myself with the use of the think aloud technique and assess its practicalities for accessing nurses' thinking process. It was also used to consider ways of identifying the weaning patients on whom observation would be based, to assess the timeframe for data collection so as to extract valuable data without interrupting nursing care, to create rapport with the participants, adapt the research approach, and re-think the research questions. Second, it was used to validate whether the data collected from participant observation and think aloud and my interpretation through preliminary analysis were meaningful.

The pilot period in each setting lasted for two weeks. However, practicalities concerning the think aloud method were resolved during the pilot period in the Scottish setting.

#### 4.3.4.2 Creating rapport with the participants

My impression, during the first week of entering the field was that nurses looked very busy and not very keen to participate, as they did not show interest in reading the information package about the study that was available in the coffee room. Indeed, only five nurses, in the Scottish setting, returned the envelopes with the consent form to participate in the study. Therefore, I needed a better approach for increasing recruitment of participants. I decided to approach the nurse who was looking after the identified patient, introduce myself and talk about the purpose of the study. After spending some time with the nurse, it became easier and more comfortable to invite the nurse to participate in the study. Nurses generally showed a welcome attitude towards me when I introduced myself as a critical care nurse who

is doing a PhD. My capacity as an intensive care nurse working in another hospital was helpful, as I did not come as an external naïve observer.

My appearance had also a major effect on participants' reaction. Wearing my own clothing would probably have increased nurses' suspicion about my presence and role in the unit. However, I was asked by the charge nurse, in both settings, to wear 'blues', the nurses' uniform, for infection control reasons, which also counted positively to the reaction I received from the staff.

Participating in some aspects of patient care enabled me to become *one of them* and receive a better, warmer and collegial reaction. My capacity as a NHS employee in Scotland provided a legal cover when I considered that the nurse I was observing was in need of help with patient care. I was keen to wear my gloves and apron to help the nurse mobilise the patient from the bed to the chair after having consent from the bedside nurse and the nurse in charge, but I was cautious not to be involved in other areas of patient care.

In the Greek setting, the first two weeks were also important to create rapport with the staff. Having had the experience from the Scottish setting and the advantage of being Greek and speaking the same language worked positively in establishing trust with the nurses. By the end of fieldwork, I became friendly with some nurses and it came natural to them to talk about issues in their working environment. My involvement in patient care was limited due to the lack of legal cover.

Usually, ethnographers have little control over the participant's perceptions of the researcher. Establishing rapport and trust are very important before starting fieldwork. If, for example, trust is minimal some of the data may be a fabrication tailored to what the participant thinks the researcher expects. The participants do not make a conscious attempt to deceive but may give answers that please the researcher (Lipson and Meleis, 1989). My cultural background and personal attributes may have influenced participants' perception of me. For instance, the working background of an intensive care nurse who works in Scotland facilitated the development of rapport

and trust sooner than an external observer with no clinical background would have. However, I came across cases when the nurse, with her aspiration to give me the ‘*right*’ answers, searched for a confirmation of the ‘*right*’ response.

In order to avoid such situations, I spent more time with the participant explaining that my effort, as a nurse-researcher, was to understand nurses’ decision-making process and not to judge their decisions while practising. Being honest improved the quality of data I obtained.

#### 4.3.4.3 Identifying the weaning patient

One of the main issues that arose, during the pilot period, was the identification of the patient cases that I would include in the main study. In the Scottish ICU, there is a computer program, the Ward Watcher, which provides information on the bed plan of the ward, the patients that are admitted and discharged and information on patients’ reason for admission. In the Greek setting, the identification of the patient cases was based on an admissions book, since there was no computerised program to provide this information. In the book, the personal details of the patient, the reason for admission and formal diagnosis, the date of admission and discharge and the outcome were included.

I identified the patient cases based on the reason for admission. Including all cases that required mechanical ventilation would result in a huge amount of unmanageable data and would make the analysis and comparison with similar patient cases in the Greek setting very difficult. Therefore, I decided to follow the weaning process of patients who were admitted with respiratory failure due to Pneumonia or exacerbation of Chronic Obstructive Pulmonary Disease (COPD) to allow comparison with similar cases between the two settings. Patients were identified on admission based on the reason for admission. All patients admitted with pneumonia and who were ventilated were included from day one; however any patients who were extubated or breathing spontaneously within 4 days were excluded as the aim was to look only at long term ventilated patients (i.e. those who were ventilated for

more than 4 days). Those patients who required mechanical ventilation for more than 4 days or had failed attempts of spontaneous breathing trials were included in the sample based on the criteria mentioned in table 4.5 and were followed until they were liberated from the ventilator for more than 48 hours.

The actual follow up of the patient would commence after 24 hours of intubation and ventilation so as to include all the phases of the weaning process, from the pre-weaning stage to liberation from any form of mechanical ventilation. Data collection continued until no more new information that answered the research questions was revealed. Indeed, within the time frame of the study, approximately 10 patient cases from each setting brought a manageable amount of data for analysis and provided useful and very interesting information on the weaning process.

#### 4.3.4.4 Time of observation

One of the aims of the pilot study was to identify the best period for observation. Being aware of the workload in intensive care, I tried to notice the most appropriate time window when collection of data would result in valuable information, without interfering and delaying patient care or increasing the observational time waste.

Weaning occurred mainly during the day, in both settings, and further reductions of ventilatory support ceased after 6 pm. Therefore, there was no reason to observe during the night. Any changes in the patient's ventilation during the night could be collected from the 24-hour observation chart. Moreover, participants were busy with basic patient care until 10 am. Therefore, it seemed that an observation window between 10 am and 6 pm would be appropriate.

Observation periods of two to four hours alternated between the cases that had to be observed the same day. For example, if there were 3 patients identified the same day, the observation period was divided in periods of two to four hours in each case between 10 am to 6 pm. To increase the possibility of capturing weaning decisions for each patient case identified, observation guidelines were developed based on two basic principles. First, each observation period had to include at least two ward round



sessions of the same patient. Second, each patient case was followed on different time slots each day of observation, so as to capture a diversity of weaning decisions. The observation schedule was assessed daily according to the patient cases included and nurses' availability to participate, but always adhering to these observation guidelines.

#### 4.3.4.5 Assessing the practicalities of using think aloud for data collection

Practical issues of accessing nurses' thinking process with the use of the think aloud technique were assessed in a pilot sample of five Scottish nurses who looked after the same weaning patient within the 2-week pilot period. The medical history of the patient is presented in table 4.6. Nurses were asked to talk about their thoughts and actions while caring for the specific patient for two hours. A microphone was attached to their shirt. Observational notes of nurses' behaviour were also taken during the 2-hour data collection period.

*Jason is a 35-year old man who was admitted in hospital 17 days ago with abdominal pain, nausea, vomiting and 24-hour jaundice. His ultrasound showed that he has got hepatomegaly, no focal lesions, a patent portal vein and ascites. Two days after admission he became confused, his urine output was poor and he had deranged clotting. The next day, he was found unresponsive by the nursing staff. He also had a Per Rectum (PR) bleed. He was intubated and admitted in ICU. His diagnosis was decompensated Alcoholic Liver Disease (ALD) with lactic acidosis. Also, his blood pressure was low and required inotrope support. A CT scan of his abdomen showed a fatty liver but no obstruction. In addition to his liver disease he developed a chest infection. Staphylococcus Aureus was isolated in his sputum, so antibiotics were prescribed. The day that the pilot study started, the patient had been on Assisted Spontaneous Breathing (ASB) mode, his clinical condition had been stable in the last 48 hours and reduction of the ventilatory support had initiated.*

**Table 4.6 Patient scenario used in the pilot study**

One of the problems encountered, during the think aloud pilot study, was that most nurses' did not feel comfortable with carrying the microphone for a period of two hours continuously. The think aloud method worked effectively for a short time and only when observing one patient at a time. It was realised at early stages that during the 2-hour observation and constant talking of the nurse, there was time spent

unproductively, without any information regarding the weaning process of the patient.

Furthermore, weaning is considered a '*snap shot*' decision-making process. Active weaning is not a condense course of action but a prolonged, tiring and sometimes complicated situation, with small, unstructured and random decisions, which rarely occupy all the working time spent in a 12-hour shift. There were periods that the nurse did not make any decision about the patient's weaning process within the 2-hour observation. For instance, there were cases that a decision to change the ventilator settings was made once at the end of the shift. Consequently, this increased the workload of observation, limited the data collected relevant to the study and increased the wastage of information.

Therefore, I decided to use the think aloud technique in an alternative and more proactive way. On the identified patient, I observed the bedside nurse for a period of 2 to 4 hours every day, and prompted the participant to verbalise his or her thoughts during the observation period. That served the purpose of extracting information on the thinking process, of thoughts and feelings that initialized actions. Inaction decisions were also captured by prompting the nurse to verbalise the thinking when monitoring the patient without acting. Information about the continuation of the weaning process was gathered from the 24-hour observation chart, the medical notes and the information received from nurses' handover sheet. The 24-hour observation chart, where the nurse documented all the changes was used to stimulate discussion on the decisions made during the observation period. Notes were taken continuously and then used to stimulate further discussion with the nurse in a reflective interview and to develop detailed reports. Most nurses felt like they were discussing the patient with another colleague.

At the end of the shift, a short 30- minute reflective interview was conducted with the nurse to capture critical aspects of the thinking process during the weaning management. The interview was semi-structured and based on incidents that occurred during observation. The interview was recorded with a digital recorder. The

nurse was asked to reflect on his or her actions about the patient's weaning and explain his or her plan regarding the weaning of the patient at the beginning of the shift, how this plan changed and the reasons for that. The participants were asked *'How do you find the patient's breathing today and what is your plan for the day?'* These open-ended question helped nurses make sense of their experience, access their short-term memory and become explicit by drawing information that was stored in long-term memory. The reflective interviews were used in place of the think aloud technique and the follow-up interviews from think aloud that were initially chosen for data collection.

Reviewing the 24-hour charts I extracted information on changes of the patients' respiratory function and followed-up their weaning progress not only during the period that I was observing but also from the days that I was not able to be present in the unit. For the days that observation did not occur, I lost the opportunity to collect valuable information on nurses' thoughts and factors that precipitated the changes of the patients' ventilation, but I could maintain a continuation of the weaning progress through chart reviewing.

Observing interactions among staff was critical so as to interpret their impact in decision-making. Such information was gathered during the medical morning assessment, the physiotherapists' review and the medical ward rounds. These data became available during observation of the bedside nurse. However, when two or three weaning patients were identified simultaneously, it was challenging to follow staff interactions. Although the observation guidelines helped in maintaining a structure of obtaining observational data, there were cases that data could not be obtained simultaneously. Therefore, data were revealed retrospectively in the reflective interview at the end of the shift, by directly asking the nurse to talk about the decisions taken during the ward round. In the smaller and more condensed Greek setting, observation of staff interactions occurred in the same manner, although it was less time consuming to follow.

Reflective interviews were conducted with eight Scottish nurses and five Greek nurses while assessing and managing their patient's weaning process. The reflective interviews were conducted on different patient cases, but very similar with regards to the reason for admission and need for mechanical ventilation. Their purpose was to access nurses' thinking process, which would provide data on what decisions they make and how they inform those decisions when assessing and managing long-term ventilated patients. Although observation of nurses' practice occurred almost every day, conducting reflective interviews with all nurses within the 137-day observation period in the Scottish setting and the 171-day observation period in the Greek setting would result in an unmanageable load of data, given that each day of observation there was a different nurse looking after the identified patient. That would have resulted in 308 reflective interviews. A preliminary analysis of the reflective interviews revealed that no more new information on nurses' thinking process emerged after the analysis of thirteen reflective interviews.

A digital recorder was used while conducting the reflective interviews. Nurses' reaction towards the microphone was hesitant. When asked the reason for this reaction, they replied that they were not used to be recorded or that they did not wish to have their thoughts recorded because that gave a feeling of formality. They also expressed their concern about the confidentiality and anonymity of the data. Although maintenance of confidentiality and anonymity of data was highlighted in the information sheet, further reassurance was offered to the participants before recording of the interview. For those nurses who refused to be recorded, I took notes while they were talking and then transcribed the jotted notes into a full report immediately after the informal interview.

The benefit of reflective interviews before the end of the shift was that they increased the credibility of the data compared to conducting follow-up interviews two or three days after the observation day with the nurse. Having the interview a few days after the observation would risk the accuracy of the data, because nurses' recollection of exact events and decisions on the day of observation was limited. Furthermore,

arranging the appropriate time and day for the nurse to be interviewed would be problematic due to the shift rotation, whereas the option of arranging an interview on the participants' free time was inconvenient.

In summary, the preliminary visit in the field was an opportunity for reflecting on the initial research design and for familiarising with the field. The revised research design is summarised in the table below (Table 4.7).

| <b>Revised Research Design</b>       |  |
|--------------------------------------|--|
| <u>1<sup>st</sup> phase of study</u> | <ul style="list-style-type: none"> <li>• Identification of the patient case for follow-up of the weaning process</li> <li>• Approach bed side nurse and obtain approval to observe</li> <li>• 24-hour chart and medical notes review each day of observation</li> <li>• Observation of the bed-side nurse for 2 to 4 hours, informal conversation about the weaning management of the patient</li> <li>• 30-minute reflective interview with the nurse at the end of the shift to reflect on the weaning decisions.</li> </ul> |
| <u>2<sup>nd</sup> phase of study</u> | <ul style="list-style-type: none"> <li>• Follow-up interviews with nurses, doctors and physiotherapists</li> </ul>   |

**Table 4.7 Revised research design**

## **4.4 DATA MANAGEMENT**

### **4.4.1 PREPARATION OF DATA**

Each day of observation, I spent two hours writing a complete report from my observation and three hours to transcribe verbatim the 30-minute reflective interview with the nurse at the end of the shift. Transcription of the interviews was facilitated with the use of media software Windows Media Player and a word processor (Windows Word 2003). The interviews from the Greek setting were translated in English soon after transcription, before being analysed. Fieldnotes from both settings were written in English; therefore, no translation was required. The follow-up interviews with the nurses, the doctors and the physiotherapists were also transcribed verbatim. All data were inserted and stored in my personal computer with a security code for access. The original reports and transcripts were filed according to the patient case and in chronological order in folders for each setting. Each report and transcript had an identification number (including the place and time of data collection), which was linked with a reference number. Hard copies of the data were produced and filed in the same way, and were stored in a locked personal cabinet.

The process of data collection was recorded in a reflective diary. This contained important information about obtaining ethical approval, gaining access to the field, recruiting research participants as well as emerging thoughts, feelings and intuitions throughout the process. Those memos were documented initially by hand and then transferred to the computer in a word file. In this way, an initial understanding of the data was gained, which formed a basis for the initial analysis.

As a novice researcher, I had limited experience in managing qualitative data, but I realised that a well organised qualitative material would facilitate the process of analysis. This was facilitated with a computerized programme that assisted the organisation, storing, coding and processing text-based and audio-based data. Such software was the NVivo 8 Student (Microsoft, QSR International Pty, Ltd), which allowed also the application of audio files and their immediate transcription and coding. Data were inserted in the programme as internal sources, initially, in five

folders; data from the 24-hour observation charts and the medical notes; reports from observation, reflective interviews; complementary follow-up interviews; and the medical history of each patient case. Then, a set of reports for each patient, a set of each patient's progress, a set of reflective interviews that referred to each patient from each setting, and a set of interviews with the nurses, the doctors and the physiotherapists were created.

## **4.5 DATA ANALYSIS**

### **4.5.1 CREATING AN OUTLINE FOR ANALYSIS**

Analysis of the qualitative data from fieldnotes, the reflective interviews with the bedside nurses and the complementary semi-structured follow-up interviews with nurses, doctors and physiotherapists took place in two phases, with a number of distinct interconnected stages that formed a outline for analysis. According to Ritchie and Spencer (1994), the outline provides a structured and disciplined approach, which allows the analyst to be creative and conceptual in order to determine the meaning, salience and connections of the data. The material was sifted, charted and sorted according to key issues and themes that I inferred from the data. The strength of this approach is that it is systematic and well defined and can be accessible because it is documented.

The first phase (Phase A) of analysis had six steps; familiarisation, identifying the main themes, indexing, charting, mapping and interpretation, at which stage the key objectives of the analysis were addressed. Some tools to help the thematic analysis were also created. This first phase aimed to identify the main themes that generated from the data and described the decisions made by nurses and their interpretation into the weaning approaches followed for each identified patient, the role that the weaning protocol played on influencing nursing practice and the socio-cultural factors that impacted on nurses' behaviour.

Since nurses' clinical behaviour was an outcome of their thinking process, it was important to investigate their cognition when assessing and managing the identified long-term ventilated patients. Therefore, the second phase (Phase B) of the analysis focused on the study of the cognitive process of thirteen nurses derived from the reflective interviews conducted at the end of their shift. To help the analysis of nurses' cognition, the concept attainment theory (section 3.2) was adopted to illustrate and understand how nurses used their knowledge to inform the decisions they made and which were observed as weaning approaches. When assessing a mechanically ventilated patient participant nurses attained attributes and concepts



related to weaning of mechanical ventilation, they generated and validated hypotheses that linked those concepts and their attributes using various decision-making strategies that resulted in clinical behaviour.

#### 4.5.2 DATA ANALYSIS - PHASE A

##### 4.5.2.1 Familiarisation and identification of main themes

The first step of the analysis was to become familiar with the material obtained during data collection. The material included observational notes, reflective interviews with the nurses, 24-hour charts and medical notes from the selected patient cases and semi-structured follow-up interviews with the nursing staff, the physiotherapists and the medical staff. Examples of a reflective interview, observational notes and a semi-structured follow-up interview are displayed in Appendix 4.11.

Observational notes were developed in a report at the end of the observation day for each patient case followed on that day. Information from the 24-hour chart that revealed changes of the ventilatory settings, which were recorded hourly on the chart, were included to demonstrate the progress of the patient each day.

Observational notes also included information on decisions made at the ward round, on the medical plan from the morning assessment of the patient, the physiotherapists' review, data from interactions among staff, and subtle influences on the above.

Information on the patients' medical history, on the cues used to form decisions and on nurses' handover was also included. Corrections were made and reflective notes taken about conduct and content and were documented in the reflective diary. The report was re-read making extra notes that had a reference to the transcript from the reflective interview. This process was time consuming but offered a first insight into the data and in understanding nurses' behaviour and thinking process.

The reflective interviews, which took place during the observation period, revealed information on nurses' assessment of the patient and the criteria used to make a decision, the changes on the ventilator settings that they made and the reason for that, their plan of action, the interaction with the physiotherapist, the interaction with the medical staff and the ward round decisions, and their reflection on the decisions made.

The complementary semi-structured follow-up interviews with the nursing staff, the medical staff and the physiotherapists revealed their perceptions on how they wean a long-term ventilated patient, the factors that influenced their decisions during weaning, the authority of decision-making and nurses' role during the process. The role of the weaning protocol and teamwork were questioned during the interviews.

The familiarisation stage involved the identification of the main elements that needed to be analysed from each data collection method; the fieldnotes, the transcripts of reflective interviews and the follow-up interviews. It resulted in the development of themes that were used to proceed to more in-depth analysis (Appendix 4.9). Each patient case was analysed according to these themes, which focused on three elements: the weaning patient; weaning process and decision-making; interactions among clinicians (Table 4.8)

| <b>Elements of data derived from analysis</b>  |  |
|--|--|
| <b>The weaning patient</b>                     | Length of ventilation                        |
|  | Length of weaning                            |
|  | Weaning outcome                              |
|  | Tracheostomy formation and time of formation |
|  |  |
| <b>The weaning process and decision-making</b> | Time of initiation of weaning                |
|  | Weaning decision episodes                    |
|  | Person who made the decision                 |
|  | Reason for the decision episode              |
|  | Information used for the decision episode    |
|  | Decision-making process                      |

|  |
|--|
| Patient's response to the decision episode<br>Approaches used to reduce support from the ventilator<br>Use of the existing weaning protocol  |
| <b>Interactions between clinicians</b><br>Person involved in interaction<br>Reason for interaction<br>Time of interaction<br>Outcome of interaction<br>Effect of interaction on the decision(s) made<br>Clinicians' perceptions about teamwork |

**Table 4.8 Elements of data for analysis**

#### 4.5.2.2 Decision Episodes Tool (DET)

To facilitate the analysis of the decision episodes that occurred throughout the weaning process of the patients and be able to refer to the decision-making processes by nurses, I created an analysis tool that provided a quantitative aspect of the data additional to the qualitative data. This tool has previously been used by Rose, et al., (2007), but was adapted to meet the needs of this study and give insight into the content and quantity of decisions made by the nurses, the doctors and collaboratively.

A decision episode was defined as an event that resulted in the adjustment of the ventilator settings, including the mode of ventilation, the positive Pressure Support level (PS), the Positive End Expiratory Pressure (PEEP), the fraction of inspired oxygen (FiO<sub>2</sub>), the Respiratory Rate (f), and Minute volumes (V<sub>e</sub>) and the reduction or increase of the sedation. It also involved decisions about initiating weaning, extubating the patient or performing a spontaneous breathing trial (SBT). For analytical purposes, decision episodes were categorised as exclusively made by nurses, or exclusively made by medical staff or collaboratively. Decisions made exclusively by the nurse or the doctor were defined as events that did not involve interdisciplinary communication before implementation. A collaborative decision was defined as one for which both medical and nursing staff had input and shared responsibility in the decision-making process. A verbal delegation of a decision from

medical to nursing staff was considered a medical decision episode (Rose, et al., 2007).

The Decision Episodes Tool (DET) facilitated the separation of the decision episodes and their aggregation. Its decision episode was documented on the DET (Appendix 4.7) as a separate episode allocating also the person who made the decision. Each decision episode was calculated for each day of observation of each patient.

#### 4.5.2.3 Adjustment of Ventilation Tool (AVT)

In order to record the adjustments of the ventilatory settings that occurred overtime during the observation period, so as to present their variation and understand the weaning trajectory, an Adjustment of Ventilation Tool (AVT) was developed (Appendix 4.8). Each event that led to an adjustment of ventilatory settings throughout the weaning process was recorded every day of observation. An event of ventilatory adjustment involved a change of the mode of ventilation, or of the Pressure Support (PS), or of the Positive End Expiratory Pressure (PEEP), or of the fraction of inspired oxygen (FiO<sub>2</sub>). Each change was recorded as a separate event even when they occurred simultaneously. The numerical and ordinal data obtained were inserted in an excel file (Microsoft Office 2003) and were organised under each patient case in each setting. These data were then used to make inferences on the trend of ventilation that was used for each patient throughout and in each stage of the weaning process and to make comparisons between cases and between settings.

#### 4.5.2.4 Descriptive characteristics of the weaning process

Descriptive characteristics of the samples included the length of stay in intensive care, the ventilation and weaning time and the time to start weaning. The ventilation time was calculated as the period from intubation until the patient was free from mechanical ventilation for more than 48 hours. Specifically, for the patients who were extubated, the ventilation time was calculated from the day of their intubation until they were successfully extubated and remained extubated for more than 48 hours. If the patient was re-intubated, the case was considered and analysed as a

recurrence of the same patient case. In the cases that the ventilation time was expected to be prolonged, a tracheostomy was performed. Successful weaning for a patient with a tracheostomy was considered when the patient was free from any type of positive pressure support delivered from the ventilator for more than 48 hours. In practice, this was achieved with different modes of ventilation.

Hence, for the patients who had a tracheostomy, the ventilation time was calculated as the period from intubation until they spent more than 48 hours without any type of positive pressure ventilation. The time to start weaning or else pre-weaning time was calculated as the time from intubation until the day that the mode of ventilation was changed from a mandatory type of ventilation to an assisted spontaneous mode. The weaning time was the period from the first day that the patient was able to take spontaneous breaths until he or she was free from any kind of ventilatory support for more than 48 hours. Finally, the day of tracheostomy was the day since intubation that the patient was tracheotomised to facilitate weaning.

#### 4.5.2.5 Indexing

The more interpretive stages of the analysis occurred when each element identified from the familiarisation stage was analysed in detail with the scope to extract those themes that described the weaning process and decision-making and the interactions among staff during decision-making. Each core theme had a number of elements or subthemes, which in NVivo language are called nodes. These are presented in Appendix 4.9.

The next step of the analysis was to apply the nodes to the data from observational notes, reflective interviews and follow-up interviews in its textual form. I read and annotated all the data according to the nodes and themes using the qualitative analysis software NVivo 8 Student (Microsoft, QSR International Pty, Ltd). During that process, I made numerous judgments as to the meaning and significance of the data. For each passage, I inferred and decided on its meaning, both as it stands and in the context of the interview or the report as a whole. The passages contained a

number of different themes each of which was referenced. With this process, patterns of association were detected within the data.

#### 4.5.2.6 Charting and mapping

Having applied the nodes to the reports and transcripts, I built up a picture of the data as a whole. I rearranged the data according to their thematic reference. I created charts with headings and subheadings for each theme across all respondents. For each key subject area, I drew up a chart and entered the data for several respondents on each chart. The ordering and grouping of the individual cases was linked to the demographic characteristics of the respondents and most importantly to their job experience. The data were collected across different levels of the respondents' knowledge and experience in the field, in order to investigate if different nurses made particular decisions or if different instances led to a particular decision. At this stage, I systematically checked for associations between attitudes, behaviours, motivations either made explicit by the respondents or derived from implicit connections.

When all the data were sifted and charted according to core themes, I extracted the key characteristics of the data and mapped them as a whole. After defining the major concepts inferred from the data, I mapped the range and nature of the phenomena that appeared during the indexing and charting phases and highlighted any extreme cases. Further, I tried to find how the different dimensions of the phenomena were linked at different points giving a range of types of cases. For example, I looked for instances of criteria that led to different actions for managing the ventilation of a long-term ventilated patient. By plotting respondents' stories and patients' progress along the identified dimensions of a phenomenon, I constructed a typology of the different styles of ventilator management that related to long-term ventilated patients.

The thematic analysis of fieldnotes, reflective interviews and follow-up semi-structured interviews revealed two main thematic sections: Practising the weaning journey; and Practice environment and the impact on decision-making. Analysis of

nurses' thinking process occurred at the second part of analysis, which is discussed below.

#### 4.5.3 DATA ANALYSIS - PHASE B

##### 4.5.3.1 Development of Concept Maps

The analysis of data in phase A provided a detailed and thorough understanding of nurses' behaviour during the weaning process of long-term ventilated patients, but it also enabled the further in depth exploration of their cognitive process when making weaning decisions, so as to meet one of the main aims of the study. From the reflective interviews a need was identified to understand how nurses processed the information they observed and used it to inform weaning decisions under a decision-making theoretical perspective. The concept attainment theory (section 3.2) provided the theoretical framework for this purpose. Concept maps were used to illustrate nurses' thinking process when managing the patients' weaning process.

The concept maps that were developed from the reflective interviews with thirteen nurses presented a series of nodes that were identified from the thematic analysis of the reflective interviews with each participant. These nodes defined the concepts used by the participants. The linkages or propositions between the concepts, as referred by Novac and Gowin (1984), were displayed as labelled lines between the concepts in the concept map. Although Novac and Gowin (1984) supported that the relationships between concepts in a concept map should be hierarchical in nature, Watson (1994), who used concept maps to examine nurses' decision-making in the clinical area, suggested that these relationships may change over time and negate this hierarchical nature. For this study, the propositions of concepts were likely to change during the observation period, therefore, concept maps were not represented in a hierarchical manner, so as to allow the different illustration of propositions between concepts, according to each participant's thinking process.

In each concept map, concepts were presented with an oval shape and orange colour, and their attributes or nodes that described them in a rectangular shape and crème colour. Attributes or nodes were linked with a dashed line. A decision that derived from attainment of concepts, for example adjustment of ventilatory support, was presented with an octagonal shape and blue colour, and was linked to the particular defining concepts with an arrow. Other decisions that related directly to the focal decision were presented in a rectangular shape with round angles and light blue colour.

Five nurses from the Greek setting and eight nurses from the Scottish setting were asked to reflect on their thinking when managing the patient's weaning during their shift. Therefore, thirteen concept maps were developed to illustrate and further analyse nurses' thinking process.



## **4.6 TRUSTWORTHINESS**

Fieldworkers, as Wolcott (1995) stated, become self-conscious about the existence of a scientific method in conducting fieldwork. He highlighted that in fieldwork there is not 'a' scientific method or technique or a way of doing something. It includes several techniques all of which can be adapted for the setting under investigation. Fieldwork is often criticised by quantitative researchers as unscientific or non-scientific or humanistic method, although even the most scientific research approaches can be neither perfectly systematic nor ultimately objective (Wolcott, 1995). The scientific perfection of a design imposes control of and control for the study, which is in contrast with the ontology of qualitative approaches that focus on providing a different and deeper understanding of what is going on in the natural setting without controlling specific variables.

Since the aim of this study was to understand nurses' thinking process and behaviour during patient care in their natural environment, the flexibility that fieldwork permits seemed very appropriate to meet these aims. I was able to go deeper into nurses' thinking process and into the dynamics of the inter-professional and interpersonal relationships, focus on the characteristics of the working environment and culture and how these influenced their weaning decisions. A more structured quantitative design would probably limit the extent of detailed information that participant information and conversations with the employees revealed. Nevertheless, to increase the rigorous methodological doctrine that guided my study, I explained in great detail the steps that I followed during the data collection and analysis, and justified the changes that occurred throughout the study.

Reliability and validity are frequently raised as critical components of research to support objectivity. According to Wolcott (1995) reliability is an artifact in fieldwork, because the rigor associated with it redirects the attention to the research process rather than the research findings. Obtaining consistency of results with a structured scientific design does not always mean that the results are accurate.

Nevertheless, reliability of findings should be considered in fieldwork, but not to the extent to turn to statistical manipulations to validate our claims.

For this study, the internal reliability of nodes and themes that developed during analysis was assessed. The nodes created needed to be tested for accuracy and precision in meaning. Internal validity was tested on two observational reports and two transcripts from reflective interviews with the nurses with a Greek critical care nurse, who was very fluent in English. The critical care nurse was also asked to develop concept maps to illustrate nurses' thinking from the two transcripts of reflective interviews. The interview and report data analysis and the concept mapping were performed independently.

The accuracy of the coding needed to be checked by a critical care specialist, who would understand the technical descriptions that the participants provided, and who would be able to compare the meanings derived from the two different languages. The specialist nurse had 10 years of critical care experience, was an active nurse in a general hospital in Athens and had never worked in the Greek setting involved in the study. Results were compared to illustrate the level of agreement (Appendix 4.10). Initial coding revealed 88.1% agreement. Disagreement appeared in 10 out of 84 identified items, which was reduced to 0% after explanation of the nature of each code and consensus in their meaning.

Kirk and Miller (1995) recommended that a carefully documented method for data gathering could establish consistency through the process of data collection and analysis. Wolcott (1995) also agreed that this method could tackle the issue of reliability, although he was not convinced that it could solve it. For this study, I created documentation sheets for the data collected, such as the AVT, the DET that occurred during observation, the reflective diary, the extended fieldnotes and the transcribed interviews in an effort to make the data accessible and increase their reliability.

Closely associated to reliability is validity, as a criterion that measures objectivity in research. In fieldwork, validity is associated with truth value, which is increased when the researcher stays in the field for a long time, as Pelto and Pelto (1978) advocated. Spending long enough time in the setting, gave me the opportunity to differentiate what is valid from what is not, and to assemble contextual information on the subject under investigation that would increase the credibility of the accounts.

To increase the rigor of the study, given that I am an experienced critical care nurse with knowledge in managing mechanically ventilated patients and their weaning, therefore, the bias in collecting and analysing the data was unavoidable, I conducted a familiarisation exercise that used the principles of auto-ethnography. The auto-ethnographic exercise, which is described and discussed in chapter five, served the purpose of identifying my role as a nurse researcher, who wished to conduct research in a particularly familiar topic. Peer reviewing with my supervisors also provided an objective view of the quality and content of data collected and of their interpretation during analysis. Peer reviewing took place very regularly and throughout the research process and writing-up period of the thesis.

#### 4.6.1 METHODS TO IMPROVE THE USE OF 'SELF'

To increase my self awareness and reduce the bias caused when interpreting participants' behaviour, I decided to keep a diary, separate from the fieldnotes, where I would record my emotions and behaviour when interacting with participants in the field. When I observed activities of the participants that I disagreed with, I recorded the reason for disagreement and my thoughts. I reflected on them and tried to link them to the existing knowledge and evidence base of weaning. Such incidents were used to challenge the existing practice in mechanical ventilation and identify factors that explained this behaviour.

Misunderstandings and predispositions when observing nurses' behaviour were noted in the diary and were used to clarify meanings when interviewing nurses. Data

from the 24-hour chart and the medical notes that I did not observe were recorded in the diary and were used to trigger informal conversation with the bed side nurse or to stimulate questions during the reflective interviews.

The difference between the observed and interviewed data was that the latter offered nurses' interpretation of weaning practices, and an objective presentation of reality, in comparison to the observational data that were prone to bias. The purpose of the diary was to reduce this bias as much as possible. Therefore, my interpretation of observed interactions among staff was inserted in the diary and was used to stimulate discussion and explanation by nurses. My interpretation of similar cases of nurse and doctor interface that resulted in conflict was also documented in the diary and was used to interrogate social behaviour within the clinical environment.

#### **4.7 LANGUAGE ISSUES**

Language in research is an important instrument and needs to be considered when analysing and interpreting the data (Wolcott, 1995). For this study, fieldwork took place in two countries with different spoken languages. In the Scottish setting, all participants spoke English, whereas in the Greek setting, they all spoke Greek. This difference created a risk in the analysis of the data, and most importantly in applying the same coding that would provide the same meaning. I needed to consider in which language I would analyse the data, since I am a Greek native speaker but I also speak English as my second language.

To reduce this risk, I decided to analyse all data in English. To start with, fieldnotes and interviews in the Scottish setting were written and conducted in English. Fieldnotes from the Greek setting, any jotted notes or reflections were written in English. The interviews with the Greek nurses, doctors and physiotherapists were conducted and then transcribed in Greek. Then they were translated into English and given to a professional translator to check any inaccuracies in translation and grammatical errors. Transcripts and fieldnotes were then inserted in the software for analysis. Technical terms used in mechanical ventilation management are alike worldwide, so there was little risk in mistranslating these terms.

## **4.8 ETHICAL CONSIDERATIONS**

The ethical principles for conducting research in the clinical environment that apply in each country needed to be considered, for this comparative study. The Scottish Executive Health Department Research Governance Framework (RGF) for Health and Community Care (Second edition, 2006) and the National Bioethics Commission guide in Greece were applied to conduct the study in the Scottish and Greek setting, respectively. In both countries, the ethical principles underlying the Declaration of Helsinki and good practice guidelines on the proper conduct of research were considered. Both frameworks state that research of human behaviour requires an ethical evaluation before initiating data collection.

Issues that needed to be considered were data protection of patients with Mental Incapacity, based on the Mental Capacity regulation (2005), since the observation of nurses occurred while caring for patients unable to consent due to their limited mental capacity by induced sedative drugs. The ethical evaluation by each Research Ethics Committee was important because fundamental values and social interests that are protected by the European and National legislation were at risk. These values related, in particular, to the respect for human dignity, the protection of physical integrity, the respect for privacy, the right to health, and the protection of personal data. Ethical issues were relative to avoiding coercion of potential participant nurses when approached for the purpose of the study.

Approval was sought initially from the Scottish Health Board. A favourable ethical consent was granted by the Scotland Research Ethics Committee A in October 2007 after presenting the documents that the Committee requested (Appendix 4.4a). The clarifications requested by the Committee concerned the maintenance of anonymity for the patients and their relatives, while the data collection was conducted in their presence. It also concerned arrangements for approaching nurses and allowing them the opportunity to decline to participate. All these clarifications were considered and appropriate changes were made in the information sheet provided to participants. A

requirement of the Ethics Committee was to provide a statement of progress of the study every year after approval was granted.

Approval was also sought and granted from the NHS University Hospital Division Research and Development Office, which stated the responsibilities and accountabilities of the principal investigator of the study. A site-specific assessment (SSA) for the intensive care unit taking part in the study was required. The site-specific assessment was granted a favourable ethical opinion by the Local Research Ethics Committee (LREC) for the specific Scottish ICU in October 2007.

The process for obtaining ethical approval for the study in the Greek hospital was different and less bureaucratic. An outline of the protocol of the study, stating the aims of the study and its effect in health care, the supporting documentation of the study (participant information sheet, consent form), and a confirmation letter that no harm is caused to the participants and that no financial requirements are expected by the hospital were requested (Appendix 4.4b). Attached were also a letter of support for the study and my curriculum vitae. Favourable ethical opinion was granted by the Research Ethics Committee and the Research and Development Department of the Hospital in October 2007, a month after sending the documents.

The values of the European legislation in conducting research, where human behaviour is studied, were respected throughout the project and specific measurements were taken. The dignity, rights, safety and well being of the patients were given priority at all times. Although patients were not directly involved in the study, they were given special consideration because their carers (the nurses) were observed while caring for them. For instance, when the nurse was occupied with the patient's personal hygiene or in other cases that privacy was mandatory, such as during treatments, I did not interrupt the care and I waited until the nurse had finished before approaching him or her.

The value of protection of physical integrity was very important and needed to be considered when deciding on my role as a researcher and a nurse in the setting.

Before starting the data collection, I negotiated my role as a nurse-researcher with the clinical nurse manager in both units. Involvement in care provision on my part was not planned, although I gladly accepted in helping with minor tasks in the course of my fieldwork, for instance helping the nurse to mobilise the patient. I considered it crucial not to be involved in conversations with nurses and doctors unless they made an attempt to integrate me. In one case, when the ward round took place, one of the consultants asked me about the patient's ability to cough and expectorate. I had to restate that I was not involved in patient care and that he should ask the nurse responsible for the patient. If it was not interfering with fulfilling nursing tasks, I would engage with the patient. In the case that I was asked professional questions by the patient's relatives, I made clear that professional issues were, in the first instance, to be discussed with the assigned nurse.

Ethical issues were considered in the case of any malpractice observed. In such case, I acted under my capacity of a health professional, stating my opinion to the nurse about the care of the patient and notifying the nurse in charge. No such incident occurred. Another case, when I used my capacity as a nurse was in the case of an emergency. For instance, one of the patients became hypoxic during observation and required physiotherapy. However, the assigned nurse was not competent to hand ventilate the patient. In that case, I immediately notified the nurse in charge who intervened.

There was no danger involved for patients as they were included in the study, but approval was required for access to their personal files. Selected patient cases were allocated a reference number during the data collection and analysis. No personal information was revealed during the transcription and analysis of the data. All participants were allocated a reference number, which was used in all phases of the study. Nicknames were used to present the data.

In the case that the patient's next of kin was present during observation, he or she was informally informed about the study allowing time to ask questions and state any objections. If the nurse who was responsible for the patient realised that observation



or chatting with the nurse caused discomfort to the patient or affected the patient care, the data collection ceased. I was flexible with the time of observation and conduct of reflective interviews allowing the nurse to refuse to participate.

Nurses did not object to being observed while caring for the patients. However, there were nurses who refused to be recorded during the reflective interviews, which was respected. In that case, I was taking notes. The follow-up interviews took place in a consultation room in the unit to maintain nurses, doctors and physiotherapists' privacy to express their views.

Nurses were approached initially to explain the purpose of the study as it was explained earlier. They were given a participant information sheet and were assured that no information of their personal details would be revealed and that they had the right to withdraw from the study at any stage. Nurses gave their consent to be observed verbally, whereas for the complementary follow-up interviews they signed a consent form. Similarly, doctors and physiotherapists who participated in the complementary semi-structured follow-up interviews were asked to sign a consent form prior to their interview.

## 4.9 CONCLUSIONS

This chapter gave an extended explanation of the theory and practicalities of conducting fieldwork in a highly complicated and demanding clinical setting. It provided a justification of the methodology selected to meet the aims of the study and demonstrated practical issues of applying the methodology in a pilot study. A strong point of the methodology was the triangulation of data collection methods, such as observation, document review, reflective interviews, concept maps and complementary semi-structured interviews, which provided a robust method to investigate nurses' thinking process during a prolonged and complicated practice and reveal the social aspect of practising in critical care.

The pilot fieldwork was beneficial for assessing the effectiveness of the methodology used to address the topic of the study. Being flexible with data collection methods and inventing tools to facilitate the analysis increased the likelihood of extracting in-depth information on nurses' judgment and decision-making when assessing and managing the patients' weaning process, as well as extorting the human social factors that influenced their decisions. The use of the concept attainment theory immersed during the first stages of the analysis and provided a theoretical structure to study nurses' cognitive process in ventilation weaning decisions. Nurses are used to verbalising their thoughts when they act, which was utilized in a flexible way during data collection. The follow-up interviews worked additionally to obtain data on what nurses think they do in comparison to what they actually do.

One of the issues that needed to be considered to secure the trustworthiness of the data was to assess my dual role as a nurse-clinician and a nurse-researcher. This was achieved with a familiarisation exercise of auto-ethnography prior to entering the main field. The next chapter elaborates on understanding my role in research as an insider and an outsider with the use of auto-ethnography.

## CHAPTER FIVE

# THE USE OF AUTO-ETHNOGRAPHY TO INCREASE SELF-AWARENESS IN CRITICAL CARE RESEARCH

## **CHAPTER FIVE**

### **THE USE OF AUTO-ETHNOGRAPHY TO INCREASE SELF-AWARENESS IN CRITICAL CARE RESEARCH**

#### **5.0 INTRODUCTION**

Clinical decisions are a daily practice of critical care nurses and define patient care and patient outcome. In order to understand how these decisions are made and guide clinical behaviour in the context of the complicated and uncertain task of weaning from mechanical ventilation, it was central to apprehend the reality of nurses' cognitive processes as mental constructions based on their existing knowledge and experience. Constructivism is the ontological position that allowed this understanding, because it emphasizes that humans are active information receivers, they build a network of concepts with their previous information and they assimilate and accommodate new knowledge with the old information, in order to build their own understanding of the new information (Cheek, 1992). Within the constructivist perspective emphasis is given to the social contents of constructing and building knowledge. Lev Vygotsky, a pioneer educational psychologist and founder of the cultural-historical psychology, accentuated that individual mental constructions develop within particular cultural groups through social interactions with peers and shared experiences (Newman and Holzman, 1993).

Under the theoretical perspective of constructivism, nurses' use of existing knowledge depends on their educational and experiential background of practising nursing within their clinical environment. This background affects their decision-making practices. As a critical care nurse with a significant educational background and experience in working with mechanically ventilated patients, I have constructed my personal beliefs and attitudes relative to the management of these patients. Within the constructivist viewpoint, my existing knowledge gained from theory, research and cumulative clinical experience cannot be discarded, ignored or

diminished, because it is subtly embodied in my nature and identity of a critical care nurse. Consequently, conducting research in a well known clinical subject created challenges in the collection and interpretation of the data jeopardising the rigor of the study.

These challenges had a twofold dimension and needed to be tackled prior to entering the two fields of data collection. First, I needed to familiarise myself with a new role in conducting research in a well-known setting, and question my position as both a nurse-clinician and a nurse-researcher. Questions, such as '*Where should I place myself in the study?*' and '*Who was I in the study?*' in both fields of research needed to be answered, given my clinical background in Scotland and Greece. Second, I needed to increase my self-awareness as a critical care nurse-researcher within two clinical environments with predefined social constructions and use the data collection methods appropriately to unearth rich and valid data that would best answer my research questions.

Using auto-ethnography, as a method, to face the above challenges seemed suitable. This chapter begins with an exploration of the literature on the use of auto-ethnography as a research method to explore oneself in the social context of a clinical environment and continues with a description of the familiarisation exercise that was used to address the challenges of conducting ethnography in a well-known clinical environment. The chapter finishes with a reflection on the use of auto-ethnography as a tool to increase self-awareness and increase the trustworthiness and rigor of the methodology.

## 5.1 AUTO-ETHNOGRAPHY AS A RESEARCH METHOD

Auto-ethnography has been used, previously, by qualitative researchers in many different ways and perspectives, although it is a relatively new field and its tenets stretch back over ethnographic research (Ree-Danahay, 2002). Ree-Danahay (1997a) stated that auto-ethnography refers to either the ethnography of the '*self*' or the autobiographical writing that has an ethnographic interest. Nevertheless, the same term is used in a twofold meaning.

There is little literature on the use of auto-ethnography as a research method, let alone its use in the clinical arena. Pioneers in auto-ethnography were Ellis and Bochner (1996, 2000), who viewed auto-ethnography as an alternative form of qualitative writing and put forward its vision in understanding the culture of an ethnographer's '*own people*'. Ellis and Bochner (2000, p. 738) beheld auto-ethnography as a means for '*...doing something meaningful for yourself and the world...*'. They perceived it as a genre of writing and research, when the researcher becomes the centre of the research, becomes introspective about own feelings and self-questions so as to understand the self and others more deeply. For Ellis and Bochner (2000), auto-ethnography was about identifying oneself and making sense and preserving coherence over the course of our lives.

The literature distinguishes between two approaches of auto-ethnographic research; an evocative approach, which highlights the importance of storytelling in understanding human experiences (Ellis and Bochner, 2006), and the analytic approach, which aims to gain insight into broader sets of social phenomena through analysis and theorising the '*insider's perspective*' (Anderson, 2006a). The debate regarding the two approaches of auto-ethnography centres on the aims of its use. Walford (2004), for instance, criticised the evocative perspective of auto-ethnography by questioning the extent to which auto-ethnographic accounts are fiction or reality. He critiqued Ellis and Bochner's (2000) work that lacked a suggestion of specific methods to explore the self, and characterised it as self-indulgence rather than research. Similarly, he pointed that Sparkes' (2002) auto-

ethnographic approach suffered from lack of clarity about whether the events were realistic or products of the author's imagination. He pointed out that if auto-ethnography is used as a research method, it should present evidence of factual stories rather than fiction as a means for self exploration and should focus on having to tell something significant to the audience.

Auto-ethnography has been used in social science, such as in Muncey's (2005) work, which focused on the complexities of teenage pregnancy. Having been a teenage mother herself, Muncey critiqued society's views of teenage mothers through her experience. In her auto-ethnography, she also discussed the power of narrative and texts in exploring this social aspect. More recently, Taber (2010) explored her perceptions of being part of the military culture, from childhood to adulthood. In her methodology, she involved a personal reflection to explore and understand the invisible elements of the military culture that affected her life, the lives of others that work with or relate to the national defence forces.

Moving to the field of health science, Smith (2005) used her experience to conduct an auto-ethnographic study for the purpose of a postgraduate course. Having sustained a brain injury, she involved five ICU survivors, including herself to explore the impact of creativity on the self-esteem of individuals who have suffered a brain injury. Participants were encouraged to use different creativity tools to express their experiences throughout their recovery and reflect on them. As one of the participants in her auto-ethnographic study, Smith (2005, p. 73) claimed that she was able to *'write reflectively, thoughtfully and introspectively about a personal subject close to her heart'*, and give voice to other individuals from her cultural environment who had sustained a brain injury. This reflective approach allowed personal experiences to become valid and rich data, leading to the conclusion that engagement in creative activities is a positive addition to brain injury rehabilitation, because of the positive impact on self-esteem (Smith, 2005).

Foster, et al. (2005) talked about the use of auto-ethnography to describe the experience of a doctoral student whose mother was mentally ill. Through the

student's personal experience in looking after a mentally ill relative, they collected valid data to inform the care of mentally ill patients and to generate new research in this field.

A Swedish study by Edvardsson and Street (2007) used auto-ethnography to explore experiences of nurses in palliative and aged care environment. The researchers conducted fieldwork and used their embodied senses to identify their own taken-for-granted assumptions about the environment, and through exploration of their feelings to trigger research questions and open up new avenues for investigation. They argued that by using their senses, they reflected on their own experiences in daily practice and questioned how patients experience their lives in such care environments. This study, although limited in focus, suggested that the interplay of understanding our own feelings through reflection can provide new ways of questioning implicit practices. Therefore, auto-ethnography can encompass an iterative process of exploring possible interpretations of phenomena in clinical practice.

For this PhD thesis, I felt the need to explore my personal experience and perceptions in managing mechanically ventilated patients and allow this to become valid data that would inform the main ethnographic study. Auto-ethnography would permit an introspective thinking and reflection on my decisions when caring for a ventilated patient, it would increase my self-awareness as a critical care clinician and it would question thoughts and behaviours that I took for granted. This was very important to occur prior to entering the field, due to my insider nature in the study, which would risk the validity of the data.

The auto-ethnographic exercise, presented in this chapter, is a narration of my experience in managing the weaning of two ventilated patients and a reflective account of the use of '*self*' as part of the research process, acknowledging the inevitable biases and their management. The challenge was to explain, in an academic context and through academic writing, professional practices that draw variously on codified clinical knowledge, wordless bodily sensations, emotional empathy, intuition, spiritual experience and subtle practices, and to outline



methodological implications of auto-ethnography in the clinical area. The following section describes the methods used to conduct this auto-ethnographic exercise.

## **5.2 AUTO-ETHNOGRAPHIC EXERCISE: METHODS**

This section gives a brief description of the working environment and my position within it, and describes the methods of data collection and analysis for this auto-ethnographic endeavour in my own area of practice.

### **5.2.1 SETTING THE SCENE**

The data collection for auto-ethnography took place in my area of clinical practice, a general ICU of a University Division Hospital in Scotland, where I have been employed as a permanent member of nursing staff for the last six years. This was a different ward from the setting where the main study was conducted. It was a 16-bedded Neurosurgical Intensive Care (NICU) and High Dependency (HDU) unit, where the majority of head injuries, as well as surgical and medical patient cases from Scotland, were admitted. The patients who were admitted in ICU required mechanical ventilation, because of existing respiratory problems that may have become complicated during their stay in ICU, resulting in delays of the patient's recovery and discharge from ICU.

Auto-ethnography took place on two days I was on a day shift. The selection of the patients was incidental with the main criterion the possibility of sustaining a reduction of ventilatory support. The two selected patients had different medical history, but they both required mechanical ventilation since admission. They were selected for observation while being in different stages of weaning, so as to explore the dimensions of the thinking process in different phases of the weaning continuum.

### **5.2.2 PATIENT SCENARIOS**

The medical history of each patient is presented in the Appendix 5.1. The first patient was admitted in ICU with severe community acquired pneumonia and was recruited for this exercise while on a pre-weaning phase. The patient was awake and alert but

no reduction of ventilatory support had been initiated. I cared for the patient on day 22 after admission, when the first effort was made to reduce the ventilatory support.

The second patient had a traumatic brain injury caused by a fall and was already on a weaning phase when recruited for this exercise. I cared for the patient on day 17 after admission, when there was a general improvement of her condition and mainly of her neurological status, and reduction of ventilatory support had already initiated.

### 5.2.3 GAINING ACCESS

There was no concern for accessing the setting, since I was a member of staff on duty. Informing the charge nurse and the clinicians who interacted with me on the days of data collection was important to address any ethical issues. Clinicians did not express any concerns after I provided an explanation for the purpose of the exercise. Anonymity of the patients and confidentiality of data was maintained throughout the familiarisation exercise. Data were secured in my personal encrypted memory stick and in a locked file in my personal computer.

### 5.2.4 METHODS TO COLLECT DATA DURING THE AUTO-ETHNOGRAPHIC EXERCISE

This section describes the methods used for collecting data during this familiarisation exercise.

#### 5.2.4.1 Verbal protocol

The verbal protocol has been shown to be a perceptive and informative method to elicit nurses' knowledge in real practice and, therefore to make the access to nurses' thinking process feasible (Aitken and Mardegan, 2000). In this case, it was used to verbalise my thoughts, my actions and intentions regarding the assessment and management of ventilation of two weaning patients. I used a digital recorder with a microphone to record my thoughts and actions while caring for those patients. I

carried the recorder throughout my shift for 12 hours, apart from the time that I was on break. I commented liberally on my thoughts and gave explanations for my actions. The use of the digital recorder facilitated the description of my involvement and behaviour when decisions were made, because exact words and phrases were used in transcription providing an accurate account of the events and interactions with clinicians.

The recorded material included not only my thinking throughout my shift but also information on the patient's progress from handover at the beginning of the shift. Discussions with the medical staff during the morning assessment of the patient and the formal ward round and informal conversation with colleagues were recorded, providing data of the social context of decision-making. It was important to comprehend the decisions that surround weaning as intangible mental constructions held by me as the bed side nurse, based on my experience and knowledge, and to uncover interactions with other members of staff that influenced those decisions (Bryman, 2001).

#### 5.2.4.2 Note taking

While observing and managing the patients' breathing, I jotted down decisions and actions in a chronological order and used these as a memory guide for narrating my story. I documented changes of the ventilatory settings and wrote the reason for the change and the factor that influenced the specific decision. This information was then cross checked with the transcript from the recorded material. Any differences in the information received were noted, so as to assess the accuracy and credibility of data.

At the end of the shift the notebook was full of abbreviations, arrows, numbers, random words that somehow related to mechanical ventilation, notes that a person with no medical or nursing background would be able to understand. These abbreviations triggered my memory, carried images to the brain and assisted me in reconstructing entire episodes. The notebook included information on my interaction with clinicians, doctors and nurses, on the reason, time, place and outcome of the

interaction. I also commented on my personal feelings during this interface. Both techniques enabled me to obtain extensive information of the patients' weaning process, capturing both depth and breadth and made the data accessible to analysis (Fetterman, 1988).

#### 5.2.5 MANAGEMENT AND ANALYSIS OF DATA

At the end of each observation, I spent four hours to transcribe the recorded material and two hours to align the fieldnotes with the verbatim transcription. How much jotted notes got down depended on the quality of memory I had and the circumstances under which I was working. Gergen and Gergen (2002) remarked that it is unwise to trust memory; notes should be written as soon as possible. I consulted those notes to write a narrative of my experience when managing each patient's breathing, which made the data accessible to interpretation. A detailed description of the context of information in relation to the patients' physical status using verbatim quotes, specific words, special language and terms when weaning the patients increased the quality and the level of detail of the fieldnotes. The reports were entered into the software for Qualitative Data Analysis, NVivo version 8 Student (Microsoft, QSR International, Pty, Ltd), for further analysis and three main themes were identified. Themes related to processing of clinical cues and task accomplishment, the documentation records used by clinicians and the communication with clinicians. These themes are presented in the following section.

To facilitate the analysis of my cognitive process, I used concept maps to give a graphic presentation of my thoughts and further inform the themes that related to the assessment and management of the patients' breathing. Clinical concepts developed not only in relation to the breathing of the patient, but also in other aspects of care, such as cardiovascular, renal and neurological function, physiotherapy, management of anxiety and pain, and pressure areas care, capturing holistically the needs of the patient. I extracted and analysed those that were relevant to the patient's weaning process and ventilation management.

## 5.3 FINDINGS

Analysis of the two reports illustrated the process I used to accomplish the tasks using my existing knowledge on clinical cues that informed my practices. It also unravelled aspects of the social context of critical care that shaped my experiences. In particular, communication with staff and documentation were tangible data of the organisational environment in critical care. These are explored in this section.

### 5.3.1 PROCESSING OF CLINICAL CUES AND TASK ACCOMPLISHMENT

The first theme that derived from analysis of the two reports referred to the processing of clinical indications that resulted in the accomplishment of a task. Each task was the outcome of a decision to assess, to plan and to intervene. It was made clear that many nursing actions were task orientated and performed rapidly and automatically without reflection. The verbalisation of the thinking process made these tasks accessible to analysis and explanation. The analysis of concept maps revealed two tasks that related to the '*management of secretions*', and to identifying the '*ability to wean*'. These decision tasks were apparent in both reports and determined the weaning practices for each case.

#### 5.3.1.1. Management of secretions

Assessment of the amount and quality of secretions from a bronchial lavage is part of nurses' daily routine and can lead to various actions, such as suctioning or hand ventilation. Suctioning the patient, after listening to the breathing sounds, incorporated a series of steps that were made automatically without thinking.

In the first patient case, I assessed the breathing sounds with the stethoscope and identified crackles, which are a symptom of pneumonia usually correlated with the production of purulent secretions. This knowledge led to the decision to perform a bronchial lavage with a closed-suction system, which produced a large amount of muco-purulent secretions. This information was combined with the fact that the

patient required increased level of oxygen (more than 45%) to maintain an adequate level of oxygen in the arterial blood, as measured from blood gas analysis. Both clinical cues, increased amount of secretions and increased oxygen requirements, supported the presence of unresolved pneumonia after 22 days of mechanical ventilation.

For the second patient, the decision to assess the patient's chest prompted different actions. Added breath sounds in the lower lung lobes instigated the decision to suction the patient, but the outcome of suctioning was also used as an additional cue to initiate a different action. In particular, suctioning revealed minimal secretions; this led to the assumption that the patient retained the secretions as a consequence of lung consolidation. Therefore, I decided to manually ventilate the patient to expand the consolidated parts of the lung and stimulate the bronchial lavage. This decision was based on the knowledge that collapsed lungs need to be inflated and manual ventilation is a very effective technique. The diagrams, below, demonstrate the different decisions made when managing the secretions of the two weaning patients.

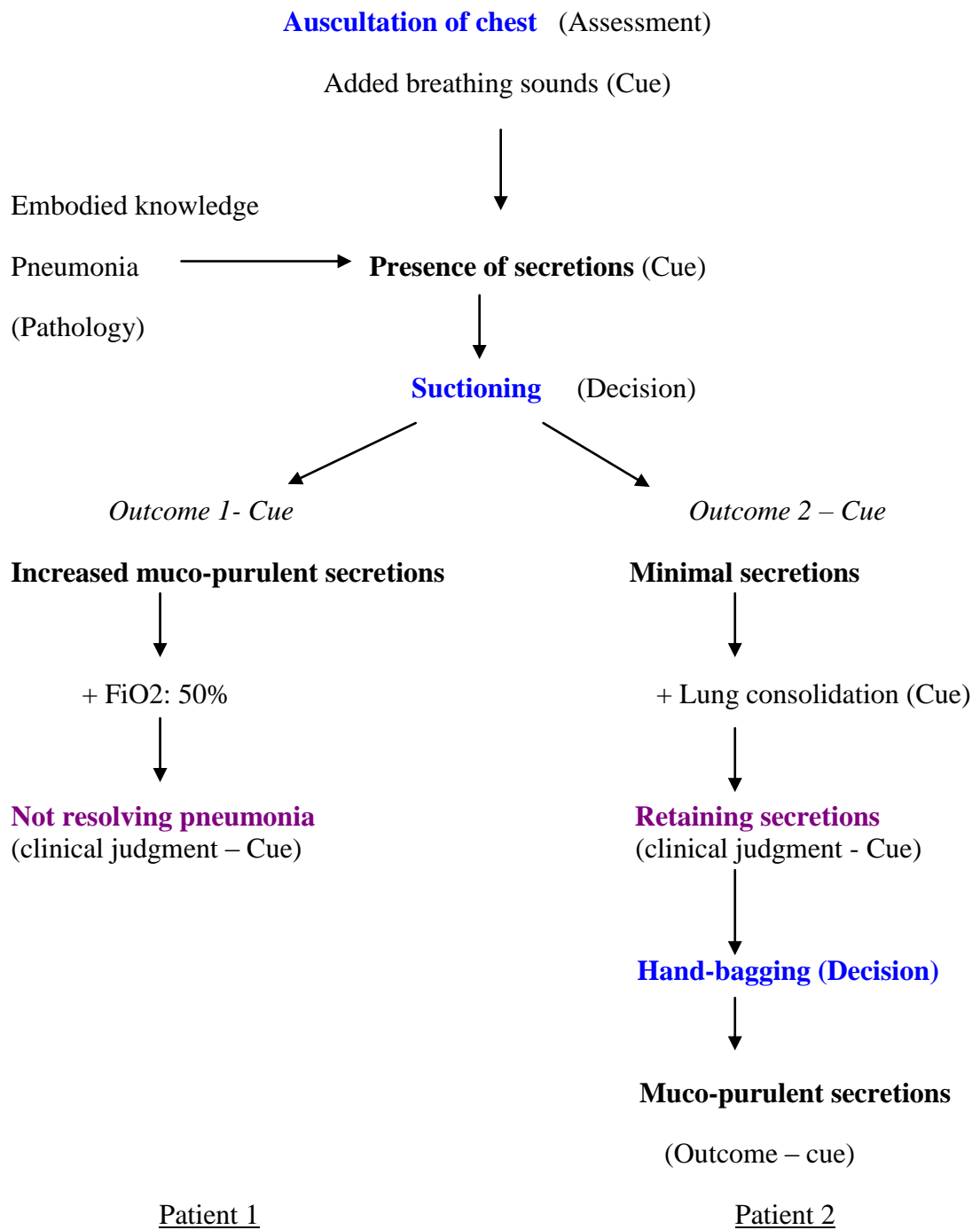


Figure 5.1 Graphical demonstration of the decisions made when managing the secretions of the patients



#### 5.3.1.2 Identifying the patients' ability to wean

In both cases, I assessed the patients' ability to sustain a reduction of ventilatory support. Managing the patients' secretions generated indications, which were combined with other clinical signs to determine the patients' ability to wean.

In the first patient case, the presence of crackles from chest auscultation and the amount and quality of secretions justified that the pneumonia was not resolved. Blood gas analysis, as a routine nursing task, showed a low PaO<sub>2</sub> (less than 10kPa), which signified that the gas exchange was inadequate. Because of the low PaO<sub>2</sub>, the patient required increased level of oxygen (FiO<sub>2</sub>: 0.5) delivered from the ventilator. All the above parameters were negative attributes of the ability of the patient to wean. Therefore, I made the assumption that the patient would require small reductions of ventilatory support, at the level of 2% to 5%. I then decided to reduce the positive pressure support by 2cmH<sub>2</sub>O, from 10cmH<sub>2</sub>O to 8cmH<sub>2</sub>O, and maintain the same amount of Positive End Expiratory Pressure (PEEP). Since the patient was able to take spontaneous breaths, as monitored from the ventilator screen, I decided to change the mode of ventilation from mandatory to spontaneous assisted mode.

For the second patient, I was aware that she was ventilated on a spontaneous assisted breathing mode for the last three days and that she sustained gradual reductions of positive pressure support via a tracheostomy until the level of 5cmH<sub>2</sub>O. The oxygen requirements were reduced to FiO<sub>2</sub>: 0.4, she was alert and orientated, she was cardiovascularly stable, and the respiratory parameters, such as respiratory rate, depth of breaths and blood gas analysis were acceptable. The clinical cues justified that the patient was able to wean, which led to the decision to reduce the ventilatory support and perform a trial of spontaneous breathing with CPAP of 5cmH<sub>2</sub>O.

#### 5.3.2 COMMUNICATION

Communication with clinicians occurred in three time points; during nursing handover, during the medical assessment of the patient and during the ward round.

At the beginning of the shift, the night-duty nurse handed over to me the patient's progress and condition in the last 24 hours. In the morning, one of the doctors assessed the patient and documented the plan for action for the day, whereas at the ward round, decisions about the patient's weaning were finalised.

Discussion with the doctor involved my insight into the patient's progress from the previous day, comments and queries I had and my decisions regarding the reduction of ventilatory support. I also discussed the acceptable breathing parameters, based on which I could decide on the level of the reduction of ventilatory support.

For instance, for the first patient, I pointed out to the doctor that the patient was too frail to sustain significant reductions of ventilatory support and I suggested changing the mode of ventilation from mandatory to an assisted spontaneous breathing. We both agreed on that. However there was a debate on the level of reduction of support. I explained that reducing the positive pressure (PS and PEEP) settings on the ventilator significantly would not benefit the patient, since he had an unresolved pneumonia and increased amount of secretions; therefore, he would not tolerate aggressive weaning. The doctor disagreed with me without giving an explanation, and insisted in reducing the PEEP by 5cmH<sub>2</sub>O. This controversy created conflicting feelings about doctors' consideration of my input in decision-making. However, as an autonomous nurse, I decided to follow a gradual approach in reducing the ventilatory support.

In the second patient case, my interaction with the medical staff resulted in agreement. I highlighted that the patient was able to cough and take deep breaths, that she was stable and appropriate for further weaning. The doctor agreed and added that the patient would be able to tolerate a trial of spontaneous breathing.

In both cases, the key decisions on the patients' ventilatory support and progress were made at the ward round. The consultant, the registrar, the junior doctors, the nurse in charge and me were involved in the discussion at the ward round. The ward round was a key interactive process not only because of the content of decisions

made but also because of my obvious involvement in the conversation as the bed side nurse. Nevertheless, it generated thoughts about the nurse-doctor relationship and its impact on decision-making.

### 5.3.3 DOCUMENTATION AND ITS INTERPRETATION

Fieldnotes included information on decisions made during the shift elicited from the 24-hour chart and the medical and nursing notes. These are the main formal documentation tools for information flow and give an insight into the clinical text used in ICU.

An important role of the nurse is to observe the patient and document the observations on the 24-hour chart hourly. This is what we call '*doing my obs*'. On the chart nurses document parameters observed from the ventilator and the monitors. These parameters describe the patient's respiratory, cardiovascular, neurological, renal condition of the patient and the sedation level. Examples of respiratory parameters recorded are the Tidal Volumes (Vt), respiratory rate (f), saturation of oxygen (SpO<sub>2</sub>), oxygen requirements (FiO<sub>2</sub>), Peak Inspiratory Pressures, Minute Volumes (Ve), Positive End Expiratory Pressure (PEEP) and Pressure Support (PS) settings (see Glossary for explanation of the terms). Nurses assess the patient's breath sounds with the stethoscope and document on the chart any added breath sounds, such as crackles, harsh or bronchial sounds. Different sounds demonstrate different pathology of the lungs and lead to different interventions, as illustrated previously.

On the 24-hour chart, there is allocated space to document the patient's fluid intake, drug infusions as well as the fluid output, such as renal output, bowel movement and gastric content. Both nurses and doctors consult the chart to decide on the patient's condition and care.

Medical notes are also one of the main formal documentation tools used by the multidisciplinary team. Decisions made during the doctors' ward round, the doctor's

morning assessment as well as the physiotherapist's input are documented in the medical notes. Information about the patients' condition was documented in a coded form, with abbreviations and technical terms that only a critical care clinician would be able to interpret. Nurses document their evaluations and planned care on a separate 6-page sheet.

An example of this codified information was the respiratory parameters set by the doctors either in the medical notes or at the back of the chart. Doctors prescribed '*Maintain PaO<sub>2</sub> > 10kPa, and PaCO<sub>2</sub> < 6kPa*'. My understanding of these technical terms was based on the existing knowledge of gas exchange that occurs at the level of pulmonary alveoli and arterial capillaries in the lungs. Oxygen and carbon dioxide, which are exchanged during breathing, are measured as pressure of gas in the arterial blood and analysed by blood gas analysis. The results of this analysis indicated the adequacy of gas exchange in the patients' lungs given the imposed positive pressure ventilation delivered from the ventilator. Adjusting the settings of the ventilator changed the gradients of pressure delivered in the lungs and consequently influenced the gas exchange at the final structures of the lungs. Therefore, my task was to adjust the ventilatory settings accordingly to maintain the prescribed pressure of oxygen and carbon dioxide in the arterial blood.

Decisions made at the ward round were also documented in a coded form in the medical notes. For instance, the medical staff discussed the possibility of starting weaning (1<sup>st</sup> patient) or attempting a trial of spontaneous breathing (2<sup>nd</sup> patient) at the ward round and documented that decisions as in the examples below:

*'Not for weaning at the moment, needs a lot of inotropes. Try PSV' (1<sup>st</sup> patient)*

Or

*'Wean ventilation, when wakens up → SBT and speaking valve' (2<sup>nd</sup> patient)*

For the first patient, this decision was interpreted as withholding weaning from the ventilator at this stage, but changing the mode of ventilation from mandatory to an

assisted spontaneous mode to assess the patient's response. For the second patient, who was already responding to reductions of ventilatory support, this instruction was interpreted as reducing the sedation further to achieve full alertness of the patient and performing a trial of spontaneous breathing to proceed to liberation from mechanical ventilation.

In summary, during this auto-ethnographic exercise, I observed and recorded information, which I used to accomplish specific tasks related to the management of the patients' breathing. It became obvious that many of these tasks were performed automatically without analytic thinking. However, verbalisation of these automatic, unconscious thought processes made them available for analysis, so as to understand how the implicit knowledge became explicit. Moreover, I interacted with other members of staff and disclosed information, which was used to make decisions for the patients' weaning process.

The following section discusses the use of auto-ethnography as a research method to understand my role as a researcher who conducted research in my own area of clinical practice.

#### **5.4 REFLECTION ON THE AUTO-ETHNOGRAPHIC EXERCISE: STRENGTHS AND WEAKNESSES OF ‘GOING NATIVE’**

This section discusses the use of auto-ethnography in increasing self awareness within the social context of a familiar setting, when the researcher plays the dual role of an insider and an outsider. In this section, I will discuss the use of auto-ethnography as a tool to understand the hidden dilemmas of being an insider participant observer, illustrating the advantages of ‘*going native*’, but also recognising the risks associated with this dual role.

As an active member of nursing staff in a Scottish health institution during the last six years, I initiated my preliminary thesis research with both a professional and personal motivation to explore various aspects of decision-making of a complicated clinical process in a highly demanding clinical environment. Clearly, being an insider participant observer creates hidden dilemmas (Labaree, 2002). A common assumption made about participant observation is that being an insider offers a distinct advantage in terms of accessing and understanding the culture (Merton, 1972; Olson, 1977). However, these assumptions are not absolute, and the insider needs to be aware of ethical and methodological dilemmas associated with entering the field, positioning and disclosure, shared relationships and disengagement.

The familiarisation exercise served the realisation and testing of these assumptions. I considered my insiderness as the key to delve into the hidden aspects of the health care organisation, and as a result of this case study, to develop a deeper understanding of the complex dynamics of the intensive care environment on decision-making that is rarely seen in the literature about mechanical ventilation and weaning. The assumption that insiderness provides the researcher with greater access and deeper understanding is often true, but one should not ignore a number of dilemmas that risk the credibility of the collected data. This section begins with examining the concept of insiderness and contrasts it with the concept of outsidership. It continues with discussing the perceived values of insiderness and the possible motivations for transition in to the role of the insider participant observer.

Discussion expands on the hidden dilemmas and effects of insiderness on the depiction of reality.

#### 5.4.1 THE CONCEPT OF INSIDERNESS AND ITS BOUNDARIES

A significant volume of literature is devoted to insider-outsider debate in qualitative research. Although most of the contemporary researchers move beyond the dichotomy of the insider – outsider researcher, most of these studies are generally reflective narratives and they are diffused among many fields of study, including but not limited to anthropology (Jones, 1970; Ohnuki-Tierney, 1984; Haniff, 1985; Burke, 1989; Headland, et al., 1990; Narayan, 1993), education (Arnold, 1994), family research (Olson, 1977; Surra and Ridley, 1991; Daly, 1992; Farnsworth, 1996; Christensen and Dahl, 1997), nursing (Kauffman, 1994; Thorne and Paterson, 2000), and social work (MacDonald, 1990; Kanuha, 2000).

In answer to the dichotomous conceptualisation of insiderness and outsiderhood when conducting research in a familiar setting, Surra and Riddley (1991) argued that insiderness and outsiderhood are points of a continuum, whereas Christensen and Dahl (1997, p. 274) replied that this dichotomous conceptualisation creates *‘a phenomenon of polarity that undermines the researcher with selecting an either/or methodological approach to the study and discourages perspectives that bring flexibility and wholeness to the research process’*.

However, researchers can have multiple insider and outsider roles (Deutsch, 1981). For this study, I was an insider as an active critical care nurse who is involved daily in assessing and managing mechanically ventilated patients and the process of discontinuing ventilatory support. I was an insider as a Greek nurse who has worked in the Greek intensive care environment, and as a nurse who has been working in the Scottish intensive care environment for the last 6 years. Therefore, I was familiar with the community of critical care nurses in both settings. However, I have not worked in the two particular settings selected for the study; therefore, I was not

immersed in their daily practice, routine and social interactions. From this angle, I was an outsider to these groups of critical care nurses and their perceptions about clinical decision-making and practice of weaning from mechanical ventilation. In that sense, the boundaries of insiderness are situational and defined by the perceptions of those being researched (Labaree, 2002).

#### 5.4.2 THE VALUE AND MOTIVATION OF 'GOING NATIVE'

The perceived value of being on the inside has been advocated by native anthropologists and feminist researchers who based their perception, in part, on the concept of epistemological privilege and the possible motivations of transition from a community member to a researcher of the community. The overall idea of '*going native*' is that the insider participant observer can provide a new perspective, a hidden meaning or a new understanding that is not achievable by an outsider (Ohnuki-Tierney, 1984). There are four broad values that support this idea; the value of shared experiences; the value of greater access; the value of cultural interpretation; and the value of deeper understanding and clarity of thought for the researcher. These are discussed below.

One of the advantages of insider participant observation, which has been advocated by feminist researchers is the idea that the researcher and the participants share and have shared the same experiences (Zinn, 1979; Okely and Callaway, 1992; De Vault, 1996). Therefore, there is a level of understanding of their perceptions as derived from past and current experiences. In this particular study, I came into the field as a knowledgeable critical care nurse with extended experience in looking after long-term ventilated patients and managing their mechanical ventilation. I was already aware of the difficulty in reducing the ventilatory support in patients with severe lung problems, of their reactions when reducing the sedation or the possibility of adverse events. I was also aware of the workload and the stressful conditions of working in such a demanding environment. The auto-ethnographic exercise helped me realise that these experiential commonalities could form the basis for building trust and



forging a strong relationship with the participants, without forgetting that constant work would be needed towards achieving insiderness and nurturing an ongoing level of trust.

Another categorical advantage of insiderness is the facilitation of greater access to the field, in particular at the beginning of the study. Being part of a society at the beginning of a study reduces the need for preliminary negotiation that an outsider must conduct to gain access to the community and approach the participants (Ohnuki-Tierney, 1984). As Haniff (1985) and Hsiung (1996) asserted, being an insider contributes to the establishment of initial levels of trust and can lead to more open exchanges with the participants. I was aware that establishing rapport with the nurses would increase the likelihood of them consenting to verbalise their thoughts while managing the patient's weaning, and consequently, capturing the details and depth of their decision-making.

Access, also, relates to the ability of the researcher to obtain certain types of information (Jones, 1970). An insider would possess a better understanding of how information is gathered, synthesized, stored and disseminated within the community. Indeed, auto-ethnography indicated that a lot of information was communicated among staff with the observation charts, the medical notes, the nursing notes, and verbally during handover and ward rounds. As a critical care nurse, I have an understanding of the recorded information about the patients' condition, the type of information and the form of information, and I am able to translate and interpret it. Access to information can also be facilitated by the fact that insiders, as unobtrusive observers, are more capable of taking advantage of '*privileged eavesdropping*' (Burke, 1989).

Interpretation of the culture of the community is another privilege of the insider, because of the advantageous position in understanding the emotive dimensions of behaviour, which an outsider would have difficulty in capturing and understanding (Ohnuki-Tierney, 1984). My background and experience in different cultural settings, in Greece and Scotland, is an intrinsic part of myself. It helped me develop

my ideas and attitude as a critical care professional and instigated the comparison between the two settings, but it also gave food for thought about how to approach the participants in each setting. In the Greek setting, I made my ethnic origin explicit to become acceptable by Greek nurses and increase recruitment. Similarly, I used my Scottish background to approach the Scottish colleagues and investigate their behaviour. Although my intrinsic cultural distinctions were meaningful to the members of each cultural group, coming as an outsider, a person who is not a member of staff of the particular settings helped me evaluate the human behaviour from a detached position.

Finally, insiderness can inform a deeper understanding and knowledge of those being researched (Zinn, 1979). Importantly, it can be used to discover greater clarity of purpose and understanding of the researcher's own work. Indeed, the auto-ethnographic exercise facilitated this purpose. The use of the verbalisation protocol made my thinking process accessible to analysis, since it was recorded. Analysis of the reports and the concept maps identified elements of the respiratory function and mechanical ventilation and unravelled the existing taken-for-granted knowledge that was built-up during daily practice. When analysing my thoughts and behaviour, I reflected in and on my behaviour, so as to increase the understanding of my decisions in clinical practice. I approached my own knowledge naïvely searching for the grounds of my decisions and actions and explained my behaviour by eliciting the tacit knowledge gained throughout the years of experience of working with mechanically ventilated patients.

According to Gergen and Gergen (2002), reflexive knowledge of fieldwork is acquired not only from an examination of outside categories, but also from the more intangible inner experience. As a nurse researcher immersed in my own culture, I used my senses to learn about my own practice when weaning a patient and to examine the meaning of my judgments, and what lay beneath my decisions. New knowledge, derived from the literature review, superimposed new experience upon past embodied knowledge and I came to terms with a changing self alive in new

contexts. I became a better and more knowledgeable clinician able to justify my decisions and advocate for my patient's care.

The values of shared experience, greater access, cultural interpretation and deeper understanding and clarity of thought are closely tied together and inform one another in a variety of ways. For this study, the aim was to obtain a deeper understanding of nurses' thinking process when making decisions about the patients' weaning process within the demanding environment of intensive care. Therefore, insider access to the norms and attitudes of clinicians would provide a detailed and profound understanding. Nevertheless, there were other motivations that indulged me to study my own clinical behaviour in the clinical environment, which are explained in the next section.

#### 5.4.3 MOTIVATIONS TO ENGAGE IN MY OWN CLINICAL ENVIRONMENT

The auto-ethnographic exercise served the purpose of reflecting on the reasons for studying my own social identity group, the critical care nurses. The first reason was to understand the nature and life experience as a critical care nurse in order to seek more meaning about my own social and professional identity. I needed to find more knowledge, more analysis, and more understanding of critical care nurses whose professional experiences were similar to mine.

Pursuing a greater understanding of critical care nurses' thinking and behaviour would offer an opportunity to explore new theoretical explanations and conceptual frameworks related to clinical decision-making in demanding and uncertain conditions, considering the cultural components of the environment. I needed to work with people who rely on communication and cooperative relationships in order to understand and interpret the socially constructed cues and patterns of communication and their effect on decision-making.

A third motivation was rooted in the desire to make a contribution to the practice of weaning from mechanical ventilation that would lead to a more meaningful and

robust service for the long-term ventilated patients. Fourthly, I speculated the need to improve my own clinical practice and expand the theoretical and practice-based understanding of decision-making in intensive care. Finally, my aim was to make visible the skills and knowledge of critical care nurse and enhance their role in terms of autonomy in ventilation weaning practices.

Despite the values and motivation of being an insider in ethnographic research, there are some hidden dilemmas, which the auto-ethnographic exercise revealed. These are discussed in the following section.

#### 5.4.4 HIDDEN DILEMMAS OF 'GOING NATIVE'

Being an insider participant observer can be criticised for risking the credibility and trustworthiness of the study. Therefore, certain introspective negotiations are necessary to avoid or limit the potential biases from imposing personal beliefs and perceptions when collecting and analysing the data. A central issue that participant observers need to negotiate as insiders is the maintenance of objectivity and accuracy of the data collected. For the outsider, this may involve triangulation of the data collection methods, such as interviewing, document analysis or reports in order to gain an accurate portrait of reality. However, the insider participant observer comes with preconceived assumptions about reality and knowledge of the community (Narayan, 1993). Although this existing knowledge can serve as a source of understanding reality, it can jeopardise the interpretation of the phenomena explored and limit the accurate understanding of the participants' positions.

For this study, there was a clear risk presenting a subjective depiction of reality. The first step to avoid risking the objectivity of the data was to explore my own beliefs as a critical care nurse when making decisions about the patients' weaning process. While most researchers recognise the influence of personality and values on qualitative research, few describe exactly how they deal with personal style, issues, values and biases. The auto-ethnography served the purpose of realising that my

personality as a clinician could bias the collection and analysis of data in the main study. For instance, I am a confident nurse and competent in weaning from mechanical ventilation, without always consulting the medical staff. However, not all nurses behave in the same manner. I realised that I needed to be vigilant when observing other nurses managing the patients' ventilation, because there was a clear risk of imposing my own beliefs to interpret their behaviour. That consequently could create uncertainty and anxiety in the interpretation of data provoking mistakes.

In order to increase the accuracy of data and reduce the possibility of imposing my own beliefs and justification of nurses' decisions, I decided to challenge nurses to explain their thoughts and judgments, in their own words and provide their own interpretation of their behaviour. I decided to ask the '*daft*' question, despite knowing the answer. This approach would reduce my intervention in explaining nurses' decisions.

During the auto-ethnographic exercise I realised that valuable data were extracted not only from verbalisation of my thoughts, but also from the observation charts, the medical notes and recording of interactions with other members of staff. This conclusion made apparent that triangulation of data collection methods would provide in depth and rich data to inform nurses' thinking and clinical behaviour as a consequence of their decisions. Triangulation of the data collection methods would involve the use of fieldnotes, document analysis of medical notes, observational charts and nursing notes, of reflective interviews with nurses when making judgments and decisions, and of semi-structured interviews with nurses, doctors and physiotherapists.

Closely related to the maintenance of accuracy is the desire of the participant observer to question the sense of familiarity that comes with the intimacy of insidership (Ohnuki-Tierney, 1984). This familiarity with the community and its members might hide the opportunity for the mundane and the ordinary to inform the study. The auto-ethnographic exercise helped recognise this risk and realise that recording ordinary events and actions that are mentioned during the course of

everyday social interaction would allow a distance from this comfort zone of familiarity. Moreover, being detached from the data for a few days and coming back to them for further analysis would allow a more detached view and would provide a more valid interpretation of the emerged meanings.

Another introspective negotiation following the insider participant observer role was the construction and deconstruction of presumptions of truthfulness in the text. Revisiting the data for the purposes of transcription, analysis and writing up, involved me re-experiencing emotions and encountering new ones. For instance, encountering the doctor's negative reaction towards my suggestion of a gradual withdrawal of ventilatory support, in the first patient case, made me reflect on the manner that medical staff perceive nurses' involvement in decision-making. I acknowledged my belief in autonomous and accountable nursing behaviour when managing the patients' ventilation, and realised that my colleagues may not support the same view. To achieve a distinction of my own presumptions and the participants', it was crucial to make my own assumptions explicit in the text. Clearly, the auto-ethnographic exercise helped me realise that insider/ outsider boundaries are transitory in ethnographic research, depending upon the methodological strategies used in the study.

## 5.5 CONCLUSION

The ethnographic literature states that the researcher is the major instrument in data collection when doing ethnographic fieldwork, but there has been little guidance for learning how to use the '*self*' as a tool, in particular in a clinical setting. The main concern in the discussion of the use of the '*self*' is to use it in such a way so as to collect valid data. Some qualitative researchers try to increase '*objectivity*' by taking into account personal biases and feelings so as to understand their influences on the research. Other researchers argue that '*subjectivity*' in fieldwork is unavoidable but should not be considered a limitation because the personal responses to the social setting can be capitalized on as rich source of data and an avenue of learning about the setting.

My role in conducting this study was addressed with the use of this auto-ethnographic exercise, which helped me identify my boundaries as an insider/nurse-clinician and an outsider/nurse-researcher and meet the challenges of this study. First, this exercise helped me examine my own decision-making as a critical care nurse who manages the weaning of long-term ventilated patients so as to understand how to study it in other nurses. Second, it helped me realise that I needed to challenge and question nurses' behaviour so as to avoid taking their behaviour for granted risking an untrustworthy interpretation of the data. Finally, it made apparent that I had to guard against my beliefs about nurses' autonomy in clinical decision-making, so as not to contaminate the interpretation of nurses' behaviour within their existing socio-cultural working environment.

The following three chapters present the findings from the main ethnographic study. The content of weaning decision-making is analysed in chapter six, while the behavioural interpretation of decisions is in chapter seven. Chapter eight focuses on the social context of intensive care and its impact on clinical decisions during weaning long-term ventilated patients. A brief description of how the data are presented in the following three chapters is provided in the next two pages.

## **PRESENTATION OF FINDINGS**

The next three chapters present the findings from the main study. To facilitate the reader in immersing into the details of the data, it is important to explain how these findings are presented and which data collection methods were used to manifest the outcomes from analysis.

All data collection methods, fieldnotes, reflective interviews and semi-structured follow-up interviews were analysed thematically following the framework described in chapter four. The 24-hour charts and medical notes were used in addition to the above data collection methods to increase the amount and detail of information. The codes developed during the analysis were applied to all data. Therefore, the same themes derived from the fieldnotes, reflective interviews and semi-structured interviews.

Chapter six illustrates nurses' thinking process when assessing and managing the patients' weaning and mechanical ventilation. The thematic analysis provided a preliminary immersion into nurses' thinking process, which was then thoroughly analysed using the concept attainment theory as a framework. The concept maps provided a graphical illustration of nurses' cognitive process.

Chapter seven depicts nurses' behavioural approach to weaning using data from the fieldnotes and the reflective interviews. Additionally data from the Decision Episodes Tool (DET) and the Adjustment of Ventilation Tool (AVT) were used to provide a quantitative view of nurses' involvement in decision-making, and to graphically present the weaning approaches used for each patient case. The DET also summarised the types of decisions nurses made with regards to the adjustment of ventilatory settings and the management of sedation, and provided a quantification of nurse-led, doctor-led or collaboratively-led decisions.

Finally, chapter eight focuses on the human factors that influenced nurses' judgments and behaviour in clinical practice. The data displayed in this chapter derived from



analysis of the complementary semi-structured follow-up interviews with nurses, doctors and physiotherapists but also from fieldnotes.

## CHAPTER SIX

# NURSES' THINKING DURING THE WEANING PROCESS OF LONG - TERM VENTILATED PATIENTS

## **CHAPTER SIX**

### **NURSES' THINKING DURING THE WEANING PROCESS OF LONG - TERM VENTILATED PATIENTS**

#### **6.0 INTRODUCTION**

This chapter focuses on nurses' thinking processes when assessing and managing ventilatory support and disconnection from the ventilator. The demographic characteristics of the nurses who participated in data collection are presented in table 6.1. The first section gives a brief description of the sample of patients in each ICU, on which the account of the weaning process and the decisions made throughout that journey was based. The second section, which is the core of the chapter, presents the findings from the analysis of the reflective interviews with eight Scottish and five Greek critical care nurses while assessing and managing their patient's weaning. The demographic characteristics of the nurses who specifically participated in reflective interviewing are presented in table 6.2. The reflective interviews were conducted on different patient cases, but very similar with regards to the reason for admission and need for mechanical ventilation.

Data from the reflective interviews were analysed with the use of concept maps (section 4.5.3.1). The concept maps illustrated specific attributes and concepts that each critical care nurse formed when processing the weaning of the patient, and displayed the cognitive strategies nurses used to process the information and attain those concepts. Each concept attained is reviewed in detail. The chapter continues with analysing the strategies for generating and validating the hypotheses that led to decisions, which provided resolution of the management of the patients' weaning.

| <b>Demographic Characteristics of Nurse Participants</b> |                           | <b>Scotland<br/>N=16</b> | <b>Greece<br/>N=17</b> |
|--|---------------------------|--------------------------|------------------------|
| Age  | 21-30                     | 5                        | 5                      |
|  | 31-40                     | 8                        | 10                     |
|  | 41-50                     | 3                        | 2                      |
|  |                           |                          |                        |
| Gender   | M                         | 7                        | 4                      |
|  | F                         | 9                        | 13                     |
| Nursing experience                                       | <5 years                  | 7                        | 5                      |
|  | 6-10 years                | 7                        | 4                      |
|  | 11-15 years               | 2                        | 5                      |
|  | 16-20 years               | 0                        | 3                      |
| Experience in this ICU                                   | <5 years                  | 9                        | 6                      |
|  | 6-10 years                | 5                        | 3                      |
|  | 11-15 years               | 2                        | 5                      |
|  | 16-20 years               | 0                        | 3                      |
| Qualifications   | Nursing Diploma           | 5                        | 1                      |
|  | BSc Nursing               | 11                       | 16                     |
|  | MSc Nursing               | 1                        | 1                      |
|  | Critical care certificate | 10                       | 2                      |

**Table 6.1 Demographic characteristics of nurse participants in both samples**

| <b>Demographic characteristics of nurses participating in reflective interviews</b> |                           | <b>Scotland<br/>N=8</b> | <b>Greece<br/>N=5</b> |
|---|---------------------------|-------------------------|-----------------------|
| Age   | 21-30                     | 2                       | 2                     |
|   | 31-40                     | 3                       | 3                     |
|   | 41-50                     | 3                       | 0                     |
|   |                           |                         |                       |
| Gender  | M                         | 4                       | 0                     |
|   | F                         | 4                       | 5                     |
| Nursing experience  | <5 years                  | 4                       | 1                     |
|   | 6-10 years                | 3                       | 3                     |
|   | 11-15 years               | 1                       | 1                     |
|   | 16-20 years               | 0                       | 0                     |
| Experience in this ICU  | <5 years                  | 6                       | 2                     |
|   | 6-10 years                | 1                       | 2                     |
|   | 11-15 years               | 1                       | 1                     |
|   | 16-20 years               | 0                       | 0                     |
| Qualifications  | Nursing Diploma           | 2                       | 0                     |
|   | BSc Nursing               | 6                       | 5                     |
|   | MSc Nursing               | 1                       | 1                     |
|   | Critical care certificate | 6                       | 2                     |

**Table 6.2 Demographic characteristics of nurses who participated in reflective interviews in both samples**

## **6.1 DESCRIPTION OF THE PATIENT SAMPLE INVOLVED IN THE STUDY**

In the Scottish setting, observation occurred for 137 days between November 2007 and March 2008. Within that period, ten patients were identified. The demographic characteristics of the patients selected for observation of their weaning progress are summarised in table 6.3. Patient one had an incomplete observation, because she was transferred to another ward, but was included in the analysis. Patient three was also included in the analysis, although he was ventilated for only four days and was extubated onto Non Invasive Mechanical Ventilation. This patient was diagnosed with Cryptogenic Organised Pneumonia (COP) and fibrotic lungs, therefore invasive ventilation was not considered appropriate or beneficial. Six patients were admitted with respiratory failure due to Community Acquired Pneumonia (CAP) and four had an exacerbation of Chronic Obstructive Pulmonary Disease (COPD) secondary to pneumonia. All patients were admitted with hypoxia, whereas those who had exacerbation of COPD were also hypercapnic. Some patients developed hypercapnia due to alveolar hypoventilation and retention of carbon dioxide. The median age of the Scottish patients was 62.5 years. All patients survived their prolonged weaning process (Table 6.3).

| Patient case | Age  | Sex | Diagnosis        | ICU length of stay | Length of time prior to commencing weaning | Ventilation time | Weaning time | Day of tracheostomy | Survival |
|--------------|------|-----|------------------|--------------------|--|------------------|--------------|---------------------|----------|
| 1            | 75   | F   | RF TYPE I, CAP   | 17                 | 1  | 15               | 9            | 10                  | Survived |
| 2            | 47   | M   | RF TYPE I, CAP   | 11                 | 5  | 11               | 6            | 0                   | Survived |
| 3            | 68   | M   | RF TYPE I COP    | 10                 | 0  | 5                | 5            | 0                   | Survived |
| 4            | 39   | M   | RF TYPE I, CAP   | 43                 | 11   | 36               | 28           | 19                  | Survived |
| 5            | 70   | M   | RF TYPE II, COPD | 17                 | 5  | 10               | 7            | 9                   | Survived |
| 6            | 55   | M   | RF TYPE II, COPD | 32                 | 4  | 25               | 20           | 9                   | Survived |
| 7            | 64   | F   | RF TYPE I, CAP   | 13                 | 1  | 15               | 10           | 4                   | Survived |
| 8            | 61   | F   | RF TYPE II, COPD | 7                  | 0  | 7                | 6            | 3                   | Survived |
| 9            | 56   | M   | RF TYPE I, CAP   | 34                 | 8  | 34               | 28           | 10                  | Survived |
| 10           | 65   | M   | RF TYPE II, COPD | 19                 | 0  | 19               | 13           | 17                  | Survived |
| Mean         | 60   |     |                  | 20                 | 4  | 18               | 13           | 8                   |          |
| Median       | 62.5 |     |                  | 17                 | 3  | 15               | 10           | 9                   |          |
| IQR          | 55.2 |     |                  | 12                 | 0  | 10               | 6            | 3                   |          |

**Table 6.3 Demographic characteristics of the Scottish patient sample. ICULOS: ICU length of stay, IQR: Interquartile range, RF: Respiratory Failure, CAP: Community Acquired Pneumonia, COP: Cryptogenic Organised Pneumonia, Lung Ca: Lung cancer, COPD: Chronic Obstructive Pulmonary Disease**

In the Greek setting, observation occurred for 171 days between April and August 2008. Within this period, eleven patients admitted with respiratory failure were identified. The demographic details of the patients identified are presented in table 6.4. Two patients were excluded from the analysis because they were ventilated for less than four days. However, one patient, who had an incomplete observation because he was discharged to another ward, was included in the analysis. Therefore, the analysis of the Greek sample is based on nine patients diagnosed with respiratory failure. The median age of the Greek patients selected was 70 years. All patients except for patient 12 and 17 survived after a prolonged weaning process. Those two patients died during observation, but were included in the analysis because of their complicated weaning trajectory (Table 6.4).

Seven patients were admitted with respiratory failure due to pneumonia and two patients with respiratory failure due to exacerbation of COPD secondary to pneumonia. From those patients, one patient had lung cancer as the underlying medical condition and two patients developed Acute Respiratory Distress Syndrome (ARDS) (Table 6.4).

| Patient case | Age  | Sex | Diagnose             | ICU length of stay | Initiate weaning time | Ventilation time | Weaning time | Day of tracheostomy | Survival |
|--------------|------|-----|----------------------|--------------------|-----------------------|------------------|--------------|---------------------|----------|
| 11           | 57   | M   | RF TYPE I, LUNG Ca   | 45                 | 6                     | 37               | 27           | 13                  | Survived |
| 12           | 71   | F   | RF TYPE II, COPD     | 32                 | 7                     | 32               | 12           | 8                   | Died     |
| 13           | 76   | M   | RF TYPE II, COPD     | 9                  | 4                     | 9                | 5            | 0                   | Survived |
| 14           | 67   | M   | RF TYPE I, CAP, ARDS | 6                  | 1                     | 5                | 5            | 0                   | Survived |
| 15           | 70   | M   | RF TYPE I, CAP, COPD | 15                 | 2                     | 12               | 11           | 5                   | Survived |
| 16           | 84   | M   | RF TYPE I, CAP       | 5                  | 3                     | 4                | 2            | 0                   | Survived |
| 17           | 70   | F   | RF TYPE I, CAP, ARDS | 44                 | 2                     | 44               | 35           | 4                   | Died     |
| 18           | 53   | M   | RF TYPE I, CAP       | 26                 | 4                     | 21               | 18           | 10                  | Survived |
| 19           | 44   | M   | RF TYPE I, CAP       | 12                 | 5                     | 11               | 7            | 10                  | Survived |
| Mean         | 67.9 |     |                      | 19                 | 3                     | 16               | 11           | 5                   |          |
| Median       | 70   |     |                      | 14                 | 4                     | 12               | 9            | 5                   |          |
| IQR          | 59.6 |     |                      | 7                  | 2                     | 6                | 5            | 0                   |          |

**Table 6.4 Demographic characteristics of the Greek patient sample. ICULOS: ICU length of stay, IQR: Interquartile range, RF: Respiratory Failure, CAP: Community Acquired Pneumonia, COP: Cryptogenic Organised Pneumonia, Lung Ca: Lung cancer, COPD: Chronic Obstructive Pulmonary Disease.**



Other descriptive characteristics of the patient sample include the length of stay in ICU, the ventilation and weaning time and the time to start weaning. The median time to start weaning was three days (IQR: 0) for the Scottish sample and four days (IQR: 2) for the Greek sample. Patient 4 from the Scottish sample and patient 12 from the Greek sample had 11 and 7 days pre-weaning time as well as the longest weaning time, 36 and 32 days respectively. This suggests that these phases were interlinked and the decisions made during the pre-weaning period influenced the duration of weaning. It was interesting to investigate the cause of this prolonged weaning time and the decisions during the transition from the pre-weaning to the weaning phase.

The median weaning time for the Scottish patients was 10 days and for the Greek patients 9 days. In both samples, there were cases that had a weaning time of more than 20 days, such as patients 4, 6, and 9 from the Scottish sample and patients 11 and 17 from the Greek sample (Tables 6.3 and 6.4). It should be mentioned, at this stage that, for some patients, reduction of ventilatory support did not occur continuously during their mechanical ventilation. Therefore, the period they spent on mandatory mechanical ventilation, when there was obvious worsening of their condition, was not included in their weaning time.

The day of tracheostomy was the number of days since intubation that the patient had a tracheostomy formation to facilitate weaning. Comparing the two samples, it appears that the Scottish clinicians proceeded to a tracheostomy formation on a median of 9 days (IQR: 3), whereas the Greek patients underwent a tracheostomy very early in their weaning journey, with a median time of 5 days (IQR: 0). Finally, the Greek patients remained in ICU 3 days less than the Scottish patients (Tables 6.3 and 6.4).

Two patients from the Scottish sample (patients 2 and 3) and one from the Greek sample (patient 14) were successfully extubated from the endotracheal tube. In the Scottish sample, three patients had a failed extubation and then a tracheostomy formation (patients 5, 6 and 10), through which they liberated from mechanical ventilation, whereas five patients received a tracheostomy for facilitating weaning

without an extubation trial (patients 1, 4, 7, 8, and 9). In the Greek sample, one patient (patient 11) had a failed extubation and then a tracheostomy formation to facilitate weaning, whereas five patients (patients 12, 15, 17, 18, and 19) received a tracheostomy without a trial of extubation. Two of them died, and the remaining three were successfully disconnected from positive pressure ventilation via their tracheostomy for more than 48 hours.

The outcome of the weaning process on each of the patient cases selected is displayed in table 6.5. The weaning outcome had four dimensions. A successful weaning outcome was considered to be when the patient remained off mechanical ventilation for more than 48 hours. For the patients who had an endotracheal tube this was considered a successful extubation from an endotracheal tube and self ventilation for more than 48 hours. For the patients who had a tracheostomy, successful weaning was considered to be when they were able to breathe via their tracheostomy without any positive pressure ventilation for more than 48 hours. Weaning was considered to have failed whenever a patient had to be re-intubated within less than 48 hours from extubation. For the patients who had a tracheostomy, failure to wean was signified by their inability to breathe without positive pressure ventilation. It was obvious that patients who had died had already failed to wean.

The patient outcome is an important measure of weaning given that weaning protocols aim to increase the successful extubations and to reduce the need for tracheotomies. In this study, the majority of patients required a tracheostomy formation, which could be due to the severity of their illness or the approaches used for weaning. This will be explored later.

Comparison of the two samples could not generate any statistically significant difference and conclusion, because the samples were very small. It was expected that patients would follow similar approaches and patterns in their weaning process, since all selected patients were admitted with respiratory failure due to pneumonia or an exacerbation of COPD secondary to pneumonia. However, following the patients' weaning process revealed differences in practice throughout the weaning continuum, from the decision to initiate weaning to the decision to perform a trial of spontaneous

breathing, extubate or perform a tracheostomy. Differences were observed not only between patient cases, but also between clinicians when managing the same patient and between settings. These differences triggered the in-depth exploration of the process of weaning and in particular the decisions made in each transition phase.

In order to understand these decisions in each particular phase of weaning, it seemed pivotal to investigate the thinking process of the bedside nurses who looked after those patients each day. The next section gives insight into how Scottish and Greek nurses made those decisions during the weaning process of each patient.

| <b>Setting</b>  | <b>Patient cases</b> | <b>Outcome</b>   |
|-----------------|----------------------|--|
| <b>Scotland</b> | Patient 1            | Transferred to another ward with a tracheostomy                |
|                 | Patient 2            | Extubated  |
|                 | Patient 3            | Extubated  |
|                 | Patient 4            | Weaned via tracheostomy and T-piece                            |
|                 | Patient 5            | Failed extubation - weaned via tracheostomy and speaking valve |
|                 | Patient 6            | Failed extubation - weaned via tracheostomy and T-piece        |
|                 | Patient 7            | Weaned via tracheostomy and speaking valve                     |
|                 | Patient 8            | Weaned via tracheostomy and T-piece                            |
|                 | Patient 9            | Weaned via tracheostomy and speaking valve                     |
|                 | Patient 10           | Failed extubation - weaned via tracheostomy and speaking valve |
| <b>Greece</b>   | Patient 11           | Failed extubation - weaned via tracheostomy and speaking valve |
|                 | Patient 12           | Unsuccessful weaning via tracheostomy - died                   |
|                 | Patient 13           | Transferred to another unit with ET tube                       |
|                 | Patient 14           | Extubated  |
|                 | Patient 15           | Weaned via tracheostomy and speaking valve                     |
|                 | Patient 16           | Extubated  |
|                 | Patient 17           | Unsuccessful weaning via tracheostomy - died                   |
|                 | Patient 18           | Weaned via tracheostomy and T-piece                            |
|                 | Patient 19           | Weaned via tracheostomy and T-piece                            |

**Table 6.5 Patient outcome of Scottish and Greek sample**

## **6.2 OVERVIEW OF THE CONCEPT ATTAINMENT THEORY APPLIED TO THE ASSESSMENT AND MANAGEMENT OF WEANING PATIENTS**

The analysis of the data collected from the reflective interviews with critical care nurses in both settings was guided by an information processing approach applied to the concept attainment theory (section 3.2). The human mind processes information in a sequence of logical rules and strategies that can be systematically mapped to enable the description of the attributes identified and demonstrate how they link together to attain a concept (Newell, Shaw and Simon, 1958; Elstein, Shulman and Sprafka, 1978). The concept attainment behaviour enables the patterning of decisions, which reflect the demands of the situations that the person needs to solve (Bruner, Goodnow and Austin, 1956).

Examination of the reflective interviews identified attributes, which derived from observation of the clinical parameters displayed on the monitor or ventilator screens and from the clinical assessment of the patient. These attributes comprised signs and symptoms of the patient's condition. Nurses received information from the medical history of the patient, but also from the latest progress of the patient's breathing, the breathing parameters and physiological variables, such as blood pressure, heart rate, temperature, and signs of infection, the level of consciousness and the level of sedation.

These attributes were processed in various manners; they were linked together to form a concept and a hypothesis was generated to link the attributes to the particular concept. Concepts attained by the participants related particularly to the breathing condition of the patient, but also to the cardiovascular stability and consciousness of the patient. A sequence of decisions was used to attain these concepts and to reach a final resolution of the problem, meaning the management of the patients' weaning. Both Scottish and Greek nurses used a variety of strategies to acquire and categorise attributes, develop hypotheses based on these attributes, and validate the hypotheses in order to ensure the accuracy and appropriateness of the attributes in their decision-making process. No significant differences were observed in how Scottish and Greek nurses used several strategies to attain the concepts in relation to the patients'

weaning management, but some differences were observed between experienced and less experienced nurses in both samples. The following sections provide a deep understanding of nurses' thinking process.

### **6.3 IDENTIFICATION OF ATTRIBUTES AND CONCEPTS RELATED TO WEANING ASSESSMENT AND MANAGEMENT**

Reflective interviews were conducted with thirteen critical care nurses, including eight Scottish and five Greek nurses. A concept map was developed to summarise the decision-making process articulated in each of these interviews. The concept maps enabled the identification of the attributes that nurses used to attain concepts relative to the weaning of the patient. Each concept map referred to the thinking process of the nurse who looked after the particular patient on the specific day, and, so, it referred to different patient cases. These concept maps (Appendix 6.1) were similar to each other with a few differences. Only one concept map of a Greek nurse was characteristically different because it dealt with an emergency situation (Appendix 6.1, concept map K). The commonalities among the individual concept maps were profound and are explained briefly.

The main concepts that developed from analysis of the concept maps and were common to all nurses were: knowledge of the patient; gas exchange; work of breathing; level of consciousness; physiological attributes; signs of infection; weanable patient; and accuracy. These concepts were connected to decisions about adjusting the ventilatory support, spontaneous breathing trials, extubation trials, mobilisation and physiotherapy. A difference among the concept maps was that not all included each concept.

Two concept maps from Scottish nurses related to performing a SBT (Appendix 6.1, concept maps D and H) and six to reducing the ventilatory support (Appendix 6.1, concept maps A, B, C, E, F and G). Of the latter six, two depicted decisions of the transition from the pre-weaning to weaning phase (concept maps A and B). In the Greek sample, one concept map referred to the ability of the patient to sustain a SBT and to the ability to extubate (Appendix 6.1, concept maps M). Three concept maps related to the reduction of ventilatory support (Appendix 6.1, concept maps I, J and L) and one to the management of an emergency situation (Appendix 6.1, concept maps K).

The concept map that described the emergency situation included the common concepts of work of breathing (WOB) and the physiological parameter cardiovascular stability, but also involved different concepts that were not apparent in other concept maps, such as airway patency. Indeed the outcome of decision-making in this patient case did not result in decisions about the patient's weaning but rather in the increase of ventilatory support due to deterioration in the patient's condition.

A characteristic of the decision scenarios analysed with the concept maps was that nurses used previous information on the patient's condition gained either from their own exposure to the patient case beforehand or from information received from handover. They carried this information in memory and used it as an attribute that informed the concepts work of breathing, weanable patient, gas exchange and level of consciousness.

Gas exchange and work of breathing were the main concepts that all nurses, both Scottish and Greek, developed when talking about the patient's weaning assessment and management. In most cases the level of consciousness was very common and was linked to the work of breathing and to the weaning of support. All nurses highlighted that the patient needed to be alert to be able to wean off the ventilatory support, and pointed out that the level of consciousness, which was affected by the amount of sedative drugs they received, affected their breathing pattern.

Differences in cue acquisition were observed between experienced and less experienced nurses in terms of the type of cues attained to define the concept of the weanable patient and how these were synthesized to arrive at a decision. Less experienced nurses focused mainly on cues that described the concepts of gas exchange and work of breathing with attributes that they derived from the monitor or the ventilator. They collected information according to the definition of the decision task and until they increased the certainty of the prominent decision. For example, if the decision task was to reduce the level of oxygen ( $\text{FiO}_2$ ) delivered from the ventilator, they defined the ability of the patient to wean by the attributes of oxygen saturation ( $\text{SpO}_2$ ) or  $\text{PaO}_2$  from gas analysis. If the decision task was to reduce the

level of positive pressure support, they focused on the level of PaCO<sub>2</sub> from blood gas analysis. Less experienced nurses continued collecting information from blood gas analysis until they reached a level of certainty.

In comparison, more experienced nurses synthesised the cues they acquired from the monitors, the patient's clinical presence, pathophysiology of clinical condition and blood gas analysis to judge the ability of the patient to wean. They did not need many encounters of the same attribute to increase certainty of their judgment, but combined attributes descriptive of many concepts (gas exchange, work of breathing, cardiovascular stability, alertness, pain, signs of infection) to make an assertive judgment. Both experienced and less experienced nurses consulted medical staff when decisions related to extubation or spontaneous breathing trials. In decisions about sedation management, although both experienced and less experienced nurses focused on signs of alertness based on the Glasgow Coma Scale and sedation score, more experienced nurse were more confident in their judgment and proceeded with sedation holds more independently compared to less experienced nurse. Examples of cue acquisition of experienced and less experienced nurse are presented in Appendix 7.3.

All participants highlighted that the assessment and management of the patient was determined by the patient's needs. However, observation of their clinical practice revealed other factors that influenced practice, such as interactions between nurses and doctors at the ward round and morning medical assessment, organisational structure of the unit and inter-personal relationships. These factors will be analysed in depth in chapter eight.

In summary, both Scottish and Greek nurses made hypotheses and used many attributes to evaluate these hypotheses. There was a constant search for attributes that nurses used to base their provisional hypotheses on and make a decision. Finally, all concepts linked together in various ways and led to decisions about adjusting support. These concepts are analysed below.



### 6.3.1 KNOWLEDGE OF THE PATIENT

Nurses' knowledge of the patient was elicited either from contact with the patient in previous shifts, from information delivered at handover and from reading through the medical notes and observation charts. Such information related to the past medical history of the patient, to the progress of the patient since admission and particularly in the last 24 hours, to various clinical tests, such as chest x-rays, biopsy, bronchoscopy, blood tests, microbiology results, which gave an overview of the clinical condition of the patient and the progress of the disease. For instance, interpretation of the chest x-ray provided information about the areas of lung consolidation, which the nurse used to inform decisions about repositioning the patient. Equally, a past medical history of emphysema or Chronic Obstructive Pulmonary Disease (COPD) was considered when assessing the patient's gas exchange and deciding on the thresholds for PaO<sub>2</sub> and PaCO<sub>2</sub>, based on which adjustment of the ventilatory settings occurred. The example below from an experienced Scottish nurse illustrates these attributes.

*Nurse H: He appears to be getting better, and he is just on CPAP of 5 with massive Tidal Volumes, starting to think that he is a candidate for extubation. So, I have put him down to 40% oxygen, his gases are still reasonable, we are not expecting fantastic gases for him since he is a long term COPD patient. [Patient 10]*

How frail the patient looked was another attribute that nurses regarded when assessing the patient. The experienced Scottish nurse below explained what a 'frail' patient meant.

*Nurse B: Because she was quite sick before she ever came here, pre-op, she was not great and I think it is going to take longer for her to become well...So I think she is going to be a long-term ventilated patient. Because she is a bit older, she's got community acquired pneumonia, which seems to be more severe. These patients seem to have a longer stay; however, often they can make a good recovery. And she had an operation as well as everything else, so... She is very fragile. And she is awake so sometimes people think that she is quite well but actually her ventilation, you know, she is on an awful lot of ventilation really and a lot of oxygen. [Patient 1]*

A resolving underlying clinical condition was mentioned as the main criterion for initiating weaning by the nurses. Keeping in mind that the patients observed were admitted with respiratory failure and hypoxia, a resolving underlying condition was manifested as improved gas exchange, improved oxygen saturation, reduction in the oxygen requirements and reduction of the amount of secretions, and improved chest x-ray film.

### 6.3.2 THE CONCEPT OF GAS EXCHANGE

One of the most common concepts that nurses used when assessing the patient's respiratory function was gas exchange. They applied various attributes to that concept, which they derived from observation of the monitor and from blood gas analysis. Attributes included the saturation of haemoglobin with oxygen ( $SpO_2$ ) and the end tidal carbon dioxide ( $EtCO_2$ ) observed on the monitor, the partial pressure of oxygen ( $PaO_2$ ) and carbon dioxide ( $PaCO_2$ ) in the arterial blood, the count of hydrogen ions (or else pH) in the arterial blood, and the base excess (BE) derived from blood gas analysis. The  $SpO_2$  was measured by pulse oximetry by a probe attached to the patient's finger, whereas the  $EtCO_2$  from a line connected between the ventilatory circuit and the monitor. These cues gave an indication of the gas exchange that occurred between the capillaries and the alveoli in the terminal structures of the bronchioles in the lungs.

The gas exchange as assessed by the above attributes indicated the adequacy of the respiratory support delivered to the patient and signalled the decisions to adjust the ventilatory settings accordingly. The decision-making strategies used to make these adjustments are discussed in section 6.6, and nurses' clinical behaviour as a result of these decisions in chapter seven.

The excerpt below by an experienced nurse provides an example of the effect of gas exchange on the management of weaning, and illustrates that the levels of  $PaO_2$  and  $PaCO_2$  defined nurses' decisions.

*Nurse A:[...] I made the decision to reduce the pressure support so as to reduce the Tidal volumes, so as not to cause further barotraumas with having the ARDS in the first place and the plan was to reduce the oxygen and wean it as able, obviously with the guidance of the ABGs. So, we were aiming, well the doctors set the parameters of a PaO<sub>2</sub> of about 9-10kPa we should aim for, because the lady has a previous history of emphysema; and if PaO<sub>2</sub> was higher than 9 or 10 and that would allow me to reduce the oxygen; and that was the plan to reduce the oxygen to about 40% and then start to reduce the PEEP, because the patient is obviously on a high PEEP of 10. So, it seemed a good idea to reduce the oxygen first so that we can have a scope to go up with the oxygen if needed, but also to reduce the PEEP after we get the oxygen to a reasonable level.*

*CK: So, what would be a reasonable level for her?*

*Nurse A: I thought about 40% maybe 50%, if you get the oxygen down to there then you know that you have half a reduction than what it was yesterday, so I felt it was reasonable to start reducing the PEEP if the oxygen was down and the PaO<sub>2</sub> was about 9-10kPa. [Patient 1]*

The acceptable levels of gas exchange attributes (SpO<sub>2</sub>, PaO<sub>2</sub>, and PaCO<sub>2</sub>) depended on the severity of the lung disease and were different in each patient case. However, in most cases, PaO<sub>2</sub> more than 9kPa and PaCO<sub>2</sub> less than 6kPa were regarded acceptable by nurses. Nurses preferred a saturation of oxygen (SpO<sub>2</sub>) between 96-100%.

In most cases, the acceptable levels of oxygenation were defined by the medical staff, who prescribed PaO<sub>2</sub>, PaCO<sub>2</sub> and SpO<sub>2</sub> threshold levels on the observation chart. For patients diagnosed with COPD, higher levels of PaCO<sub>2</sub> than the normal (permissive hypercapnea) and a lower level of PaO<sub>2</sub> than the normal (permissive hypoxia) were accepted. More specifically, a PaCO<sub>2</sub> less than 9kPa and a PaO<sub>2</sub> more than 9kPa were prescribed by the medical staff as threshold points to adjust the level of positive pressure delivered. Both experienced and less experienced nurses used this information as a baseline criterion that influenced their thinking and guided their decisions.

Criteria such as the Rapid Shallow Breathing Index (RSBI) and the ratio of PaO<sub>2</sub>/FiO<sub>2</sub>, which are supported as reliable indexes to assess readiness for weaning,

were rarely reviewed and used for assessing the patient. Those criteria were not included as parameters in the weaning algorithms that the two ICU had implemented. In both settings, gas exchange determined nurses' behaviour in adjusting the ventilatory settings.

### 6.3.3 WORK OF BREATHING (WOB)

Work of breathing was signified by direct attributes, such as the spontaneous respiratory rate, the tidal volumes, and use of accessory muscles, and indirect attributes such as the amount and quality of secretions, breath sounds and bronchospasm. In most cases, the increased WOB, indicated by a respiratory rate of more than 35 bpm and tidal volumes of less than 350ml as well as the use of accessory muscles were criteria that nurses observed and interpreted as signs of increased effort and respiratory fatigue. Deranged levels of the attributes that described the concept of gas exchange, as mentioned previously, were conceived a consequence of increased respiratory load.

Analysis of the decision episodes revealed that in some cases (patients 4, 6, 9, 11, 12, and 17) no progress in weaning was made with the given threshold points of respiratory rate and tidal volumes. In such cases, nurses were flexible with the acceptable thresholds of the attributes that described the WOB. For instance, when the patient remained on the same level of positive pressure support because the respiratory rate was 35 bpm, nurses were keen to accept a respiratory rate of 40 bpm, a tidal volume of 300ml or a SpO<sub>2</sub> of 90%, in order to proceed to reduce the ventilatory support. It should be mentioned that the decision to change the threshold levels was made in consultation with the medical staff.

Nurses at any level of experience listened to the patient's chest to identify the quality and extent of breath sounds in the fields of both lungs. Additional breath sounds, such as wheeze, harsh, crackly breath sounds indicated the presence of specific clinical conditions such as pulmonary oedema, increased amount of secretions, pneumonia, or atelectasis (lung collapse).

Identification of such clinical indicators prompted specific interventions. For example, added sounds usually signified the presence of increased amount of secretions, which the nurses removed with the use of a closed suction system that was attached to the endotracheal tube of the patient. This intervention occurred very frequently throughout the day and it was a form of physiotherapy. Nurses along with the physiotherapists played an important role in providing physiotherapy. In the case that the patient had added breath sounds but retained the secretions, manual ventilation for a short period was provided in order to inflate the collapsed alveoli to promote perfusion and ventilation of the alveolar capillaries and to facilitate expectoration of secretions. Nurses provided manual hyperinflation with a respiratory bag (C-circuit) attached to the oxygen supply.

#### 6.3.4 LEVEL OF CONSCIOUSNESS

Weaning of ventilatory support so as to allow the active involvement of the patient would not occur unless the level of sedation was reduced and the patient started becoming alert. Nurses in both settings assessed the level of consciousness of the patient with the use of the Glasgow Coma Scale (GCS) combined with the Richmond Agitation and Sedation Scale (RASS). These scales indicated the behaviour of the patient on various external stimuli, such as pain, noise, voice and light, and deduced the level of alertness. Both experienced and less experienced nurses searched for signs of anxiety or agitation when the patient started gaining consciousness.

An anxious patient was described as a patient who became tachypnoec, was taking shallow breaths, became tachycardic and/or hypertensive, had a worried looking face, and was grimacing. Most nurses considered pain or discomfort a reason for anxiety. Agitation was described as being combative and aggressive, becoming tachypnoec; for instance, some patients had a respiratory rate of 50 bpm when they were agitated and became hyperactive, for example, trying to get off the bed. Such phenomena were apparent when nurses reduced the infusion rate of the sedative drugs to allow patients to be more active in breathing.

One of the reasons that caused nurses to link the level of consciousness to patient's behaviour when weaning, was sleep deprivation. A Greek nurse with 5 years of experience identified this attribute when she talked about assessing the patient's readiness to wean.

*Nurse J: I have to know that someone is comfortable enough and that he is able for spontaneous breathing effectively. You have to know that they are not compromised from being septic, that they have been well rested, a lot of people lose their sleeping cycles, they are awake all night and then we are struggling to keep them awake during the day. You are not going to have an easy time weaning them if they are not rested. [Patient 17]*

Anxiety, agitation and lack of cooperation with the patient after extubation would usually result in the decision to re-intubate the patient, because the patient was not able to cooperate during physiotherapy resulting in retention of secretions, inadequate gas exchange and a worsening breathing pattern. This occurred in cases 5, 6 and 10 from the Scottish sample and case 11 from the Greek sample.

The opposite attribute to anxiety and deprivation was the patient's inability to wake up even when the sedative drugs were discontinued. Patients who were not responsive to any applied stimuli, such as voice, light, touch or pain were described as 'flat' by the nurses. Nurses highlighted that the behaviour of the patient, when the sedation was stopped, determined the ability to breathe spontaneously and consequently to move from the pre-weaning phase to the weaning phase.

Moreover, in the cases that the patient was assessed for ability to extubate, nurses did not proceed to extubation unless the patient had GCS of 10/10; meaning that he or she was fully alert, orientated, obeyed commands, such as squeezing hands, wiggling toes to command, and had sustained eye opening. Tube tolerance was another attribute that was linked to the level of sedation, since the opioid drugs offered pain relief and comfort to the patient. Nurse H, below, demonstrated that.

*Nurse H: I thought that he fulfilled all the criteria, because you can deal with a wheeze to be extubated and the sedation was at a level that he was awake enough and it could be easily stopped. He was very awake*

*although he was on propofol that was just to keep the tube in; it was not to keep him asleep; it was just to keep him from pulling the tube out himself. If we didn't take the tube out I think he would have taken it out himself.*

*CK: Was he very agitated?*

*Nurse H: Yes, he was frustrated with the tube. [Patient 10]*

However, in the cases that the patient was weaning through a tracheostomy tube, the nurse attempted a trial of spontaneous breathing with a speaking valve or T-piece even when the patient's GCS was less than 10/10. For instance, in many cases, the patient was confused and disorientated, but was tolerating disconnection from the ventilator and breathing through a T-piece.

#### 6.3.5 PHYSIOLOGICAL ATTRIBUTES

Physiological criteria that both Scottish and Greek nurses assessed were cardiovascular stability, which was described with three main attributes: the blood pressure, the heart rate and the fluid balance. The heart rate (HR) and the electrocardiogram (ECG) were automatically measured by means of telemetry, which was attached to the patient's chest and to the monitor. An arterial catheter inserted into one of the patient's arteries (usually the radial or femoral artery) was connected to the monitor with a line and a transducer and provided real-time, continuous monitoring of the blood pressure.

Some patients required the use of inotropic<sup>5</sup> drugs to maintain a stable cardiac output and blood pressure. Increased amount of inotropic support was a contraindication of weaning during the pre-weaning phase, because it signified the patient's instability and therefore, inappropriateness to wean ventilation. However, low requirements of

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<sup>5</sup> Inotropes are medicines that increase the force of cardiac contraction, which in turn increases cardiac output and leads to increase in blood pressure. They are used in cases of hypertension or hypotension and cardiovascular instability (Berne and Levy, 2001).

inotropic support were necessary for some patients during the weaning phase to maintain an adequate cardiac output and Mean Arterial Blood pressure (MAP), but were not considered as negative attributes to decisions about reducing the ventilatory support by both experienced and less experienced nurses. No patients needed inotropic support when they entered the spontaneous breathing phase.

Another parameter that correlated with the cardiovascular function and had an indirect impact on the WOB was the fluid balance. Nurses monitored and recorded the total input and output of the patient in order to measure the fluid balance. The fluid input was any type of medication that the patient received, continuous or intermittent infusions and nutrition. These were calculated hourly and documented on the observation chart. This amount was subtracted from the renal or any other output of the patient and provided the fluid balance hourly. The total 24-hour fluid balance was calculated and documented on the observation chart.

More experienced nurses referred to this attribute. They described patients as overloaded when they had an increased positive fluid balance and oedematous extremities. Both Scottish and Greek nurses considered this to be a barrier for the patients' weaning progress, because it increased their WOB.

#### 6.3.6 SIGNS OF INFECTION

Another concept that nurses attained, as illustrated from the concept maps was the prevalence of infection. Increased temperature, usually more than 38 degrees Celsius, and increased white blood cell count were associated with a possible underlying infection. Blood cultures or samples from bronchial lavage confirmed the existence of infection and identified its source.

High temperature alone was not considered a criterion for not attempting a reduction in ventilatory support, a trial of spontaneous breathing or even extubation. However, when the increased temperature was combined with the quality and amount of bronchial secretions, this was considered a negative attribute to weaning. The excerpt



below demonstrates that this less experienced Scottish nurse was reluctant to reduce the ventilatory support because of the increased amount of bronchial secretions.

*Nurse C: When I looked after him yesterday, we had a lot of trouble with the secretions and over the period of the afternoon, so we decided, between the physiotherapist and me, to put him on the humidified circuit with the view to try to reduce the secretions over the next while. So when I came on this morning we were still getting a lot of secretions off his chest but they were coming up a lot easier. I left him on the same ventilation overnight, so he had been on 60% and then reduced it to 55% a couple of hours before I came on. They had not changed his support at all. I had him up to 32 over 12 yesterday, in view of his consolidation, so I haven't changed anything in view of his support at all. I have not been able to reduce his oxygen at all over the day, because of his gases and sats as well. [Patient 2]*

The excerpt highlighted that nurses combined the concept of infection with the concept of gas exchange to identify whether the patient was able to sustain a reduction of ventilatory support. The concepts analysed so far created the holistic concept of the 'weanable patient', which is described in the next section, and which determined the decisions to adjust the ventilatory support to free patients from artificial breathing.

#### 6.3.7 CONCEPT OF A WEANABLE PATIENT

Analysis of the decision episodes with the use of concept maps revealed that nurses referred to the concept of a 'weanable patient' when they decided about adjusting the ventilatory support. This concept was attained by combining various attributes descriptive of the concepts already mentioned, and was attained during decision-making in each phase of the weaning continuum, the pre-weaning phase, the weaning phase and the transition to spontaneous breathing trial or extubation.

To identify a patient as weanable, nurses looked for the criteria that would confirm their hypotheses about adequate gas exchange, the WOB, and the level of consciousness. Other concepts, such as infection or other physiological parameters

added to the attainment of the concept of a '*weanable patient*'. It seemed, though, that some concepts were more dominant in each phase of weaning. For instance, the transition of the patients from a pre-weaning phase to a weaning phase was determined mainly by their level of alertness and their ability to take spontaneous breaths. During the weaning phase and the transition to spontaneous breathing, experienced nurses appeared to incorporate all the concepts to decide on the adjustments of the ventilatory support in comparison to less experienced who focused on the gas exchange and WOB. However, the attributes of gas exchange and WOB were first considered for the provisional hypotheses that both experienced and less experienced nurses made.

The concepts that were described in the previous sections with the allocated attributes are summarised in table 6.6 below. Each column recaptures the attributes that nurses used to identify a patient as weanable in each phase of the weaning continuum. There were no significant differences between Scottish and Greek nurses regarding the attributes and concepts attained in their decision-making process.

#### 6.3.8 THE CONCEPT OF ACCURACY IN ASSESSING WEANING PATIENTS

One of the concepts that emerged from analysis of reflective interviews with the thirteen critical care nurses was the concept of accuracy of the attributes that described the concepts analysed above. All participants ensured that the attributes attained with their assessment were accurate.

For instance, the accuracy of the SpO<sub>2</sub> attribute was tested by observing the waveform recorded on the monitor from the pulse oximeter probe. If a low SpO<sub>2</sub> recording with a poor waveform was observed, the nurse manipulated the oximeter probe so as to get a better signal. This usually occurred in patients who had cool extremities; therefore, the probe did not pick up the pulse from the patients' fingers. A similar example was the recording of EtCO<sub>2</sub>, which depended on the probe that was attached to the ventilator circuit. In cases of uncertainty about the accuracy of

those attributes, nurses obtained more precise view of gas exchange from the results from blood gas analysis, which revealed the levels of PaO<sub>2</sub> and PaCO<sub>2</sub>.

Another example of searching for accuracy was observed when one of the Greek nurses monitored that the ventilator recorded a respiratory rate of 50 bpm, while the patient was on Pressure Support Ventilation (PSV). The nurse, however, observed the clinical appearance of the patient, which did not indicate an increased WOB. The nurse did not rely on the recording from the ventilator, but calculated the breaths of the patient over one minute to affirm that the patient was not tachypnoec.

All the concepts described in this section were attained by nurses during assessment. Nurses processed this information and made hypotheses that linked these concepts together and arrived at a decision about the weaning management of the patients. The hypothesis generation is described in the following section.

| Concepts                   | Pre-weaning stage   | Weaning stage   | Transition to trial of spontaneous breathing  |
|----------------------------|---|---|---|
| <b>Gas exchange</b>        | FiO <sub>2</sub> < 0.7<br>PaO <sub>2</sub> > 10kPa<br>PaCO <sub>2</sub> < 6kPa<br>SpO <sub>2</sub> >94% | FiO <sub>2</sub> <0.7<br>PaO <sub>2</sub> >8kPa<br>PaCO <sub>2</sub> <6kPa (in some cases PaCO <sub>2</sub> <9kPa)<br>SpO <sub>2</sub> >94% (in some cases SpO <sub>2</sub> >88% was acceptable)<br>PEEP<15cmH <sub>2</sub> O | FiO <sub>2</sub> level reduced significantly the last 24 hours<br>FiO <sub>2</sub> < 0.5<br>Acceptable PaO <sub>2</sub> and PaCO <sub>2</sub> for the patient<br>SpO <sub>2</sub> >94%<br>PEEP<10cmH <sub>2</sub> O |
| <b>Work of Breathing</b>   | Able to take spontaneous breaths  | Breathing pattern and use of accessory muscles<br>f<35 (in some cases f<40)<br>V <sub>t</sub> >350ml<br>RSBI and PaO <sub>2</sub> /FiO <sub>2</sub> rarely used   | Breathing pattern and use of accessory muscles<br>f<35<br>V <sub>t</sub> >400ml<br>Cough reflex present   |
| <b>Physical parameters</b> | Cardiovascular stability with a small amount of inotrope support or without inotrope support            | Cardiovascular stability with a small amount of inotrope support or without inotrope support<br>Lack of arrhythmias<br>Overloaded   | Cardiovascular stability, no inotrope support<br>Lack of arrhythmias<br>Overloaded  |

|                                 |  |   |  |
|---------------------------------|--|---|--|
| <b>Level of consciousness</b>   | Patient gains partial consciousness when sedation reduced or stopped | Minimal amount of sedation<br>GCS: 7-10/10<br>Anxiety/Agitation<br>Pain<br>Comfort and adequate sleep<br>Neuropathy                           | Sedation stopped<br>GCS: 9-10/10<br>Alert and cooperative<br>Anxiety/Agitation<br>Pain<br>Comfort and adequate sleep |
| <b>Knowledge of the patient</b> | Underlying condition resolved or resolving<br>Severe lung problems   | Underlying condition resolved or resolving<br>Pulmonary oedema<br>Severe lung problems<br>Ability to clear secretions<br>Cough reflex present | Underlying condition resolved<br>Ability to clear secretions<br>Cough reflex present                                 |
| <b>Infection</b>                | Pyrexia<br>Level of WBC<br>Amount and quality of secretions          | Pyrexia<br>Level of WBC<br>Amount and quality of secretions   | Pyrexia<br>Level of WBC<br>Amount and quality of secretions  |

**Table 6.6 Concepts and their attributes attained by Scottish and Greek nurses**

## **6.4 HYPOTHESES GENERATION RELATED TO THE ASSESSMENT AND MANAGEMENT OF WEANING FROM MECHANICAL VENTILATION**

The concepts that nurses in both settings attained were linked together through a series of relationships to form hypotheses. These relationships were made apparent during the reflective interviews when nurses were prompted to give an explanation of their thinking. What became obvious was that the concepts of gas exchange and WOB were the first line concepts that nurses processed while weaning the patient. An immediate concept, that linked firstly with the WOB and consequently with the gas exchange, was the level of consciousness; the hypothesis generated was that if the patient was not awake enough, he or she could not take any spontaneous breaths, and therefore could not wean off the ventilator. This hypothesis was common specifically during the pre-weaning phase, when the patient was identified as able or not to initiate weaning.

Another hypothesis that linked the above attributes was related to the WOB and the attributes of anxiety and agitation. Most nurses viewed the increased respiratory rate as an indication of anxiety, especially when the patient was on a weaning phase or when having a trial of spontaneous breathing, which led them to the induction of more sedation, either in the form of a continuous infusion or in boluses. There was no difference between the two settings in the method of sedation used.

Attributes of each concept were combined to make a judgment and confirm a hypothesis generated. For instance, observation of increased respiratory rate, low tidal volumes, and low SpO<sub>2</sub> and worsening gas exchange indicated the increased WOB and respiratory fatigue.

One of the Scottish nurses linked the worsening gas exchange and hypoxia with the attribute agitation. The verbalisation of her thoughts revealed that she processed and combined various attributes indicative of different concepts, such as increased oxygen requirements (FiO<sub>2</sub>), respiratory rate and reduced level of sedative drugs to reach to the judgment that the patient is agitated and therefore his breathing effort is

affected. The patient was on a weaning phase, and was ventilated with an assisted spontaneous mode.

*Nurse E: While his family was there he had been getting more agitated, his respiratory rate had gone up and the FiO2 demands had gone up as well, so I just had to go with him, he was kind of leading the way rather than me. [Patient 3]*

Once these hypotheses were made, both Scottish and Greek nurses tended to validate them using various methods. These methods are explained in the next section.

## 6.5 HYPOTHESES VALIDATION WHEN ASSESSING AND MANAGING WEANING FROM MECHANICAL VENTILATION

When nurses made a hypothesis, they searched for evidence that would confirm not only the hypothesis made but also the accuracy of the attributes acquired and their relation to the concept they were linked to. Such evidence would either strengthen the hypothesis or weaken it. Both Greek and Scottish nurses used a variety of methods to validate their hypotheses.

In some cases nurses validated a hypothesis by *recourse to an ultimate criterion*. An example observed, was when they adjusted the level of FiO<sub>2</sub>. Nurses compared the PaO<sub>2</sub> value derived from blood gas analysis with the threshold value of PaO<sub>2</sub> prescribed by the medical staff to decide about reducing or increasing the level of oxygen delivered from the ventilator. Nurse A explained that in the excerpt below:

*Nurse A: So, we were aiming, well the doctors set the parameters of a PaO<sub>2</sub> of about 9-10kPa we should aim for, because the lady has a previous history of emphysema, and if PaO<sub>2</sub> was higher than 9 or 10, that would allow me to reduce the oxygen. [Patient 1]*

The ability of the patient to cough and expectorate was used as a distinguishable attribute of work of breathing when the patient was assessed as eligible for extubation. For instance, when the patient did not have a strong cough reflex, the nurse hesitated to extubate the patient, because of the risk of secretion retention, since the patient would not be able to expectorate.

All nurses searched for accuracy of the attributes collected. They tested the accuracy of the attribute by consistency in two different ways. They compared the current value of the attribute to previous values they attained during their shift or to values from previous days of observation. A characteristic example was validation of the SpO<sub>2</sub> attribute, which was monitored with pulse oximetry. In the case that the patient had cold extremities, the signal from the oximeter was poor and therefore, it did not record the real oxygen saturation in haemoglobin. When the nurse obtained the same

low recording of SpO<sub>2</sub> after changing the pulse oximeter, she tested the accuracy of the recording and confirmed her hypothesis that the patient was hypoxic.

Another example of testing by consistency was when nurses compared specific attributes before and after an intervention. For example, nurse I in the Greek sample, observed that the level of PaCO<sub>2</sub> from blood gas analysis was high and decided to increase the level of positive pressure support from the ventilator. Then, she checked another blood gas to see any consistency of the value of PaCO<sub>2</sub> after the intervention.

*Nurse I: I increased the pressure support to 15cmH<sub>2</sub>O at 14:00 and the PEEP was 6cmH<sub>2</sub>O. That's because the PaCO<sub>2</sub> on the blood gas I did at 10:00 was 7.98kPa. There was no change on the tidal volume and respiratory rate. I did another gas at 14:00, which showed a PaO<sub>2</sub> of 9.84kPa and PaCO<sub>2</sub> of 7.31kPa. The patient remained on PS 15cmH<sub>2</sub>O and was still taking 360ml volumes and 30 breaths. [Patient 11]*

In the case that change of these parameters was significantly worse than before, the nurse valued the negative outcome and increased the level of support to the previous level. In the case that these parameters remained unchanged, the nurse valued the positive outcome and continued reducing the ventilatory support.

Another validation test by consistency was comparison between similar cases. When the nurse had looked after the patient previously and had knowledge of the patient's behaviour, he or she compared the current behaviour with the previous behaviour. For instance, in patient case 12 from the Greek sample, the nurse was aware that the patient became anxious, tachypnoeic and tachycardic when the sedation was reduced abruptly, so she followed a more gradual approach to sedation management. Also, nurse H from the Scottish sample searched for consistency when assessed the patient's breathing pattern.

*Nurse H: As I was saying the patient has been on 50% oxygen, but he looked as he looks just now, his breathing pattern is the same all day, for several days in a row and a few days on CPAP of 5cmH<sub>2</sub>O, he is cooperative [...]. [Patient 10]*



When there was uncertainty about the relationship of the concepts attained leading to a specific decision, nurses validated their hypothesis both by consistency and by consensus. Cases of uncertainty were mainly the decision to extubate a patient, the decision to change the mode of ventilation from mandatory mode to an assisted spontaneous mode and the decision to perform a trial of spontaneous breathing. Both Scottish and Greek nurses followed a trial and error approach that was translated to adjustments of ventilatory settings and used the outcome of this approach as new information that would validate the initial hypothesis. Nurses searched for more accurate attributes that would confirm their initial hypothesis and requested an official consensus by the medical staff to validate their decision, when still uncertain. These cases are illustrated in the examples below.

*Nurse B: She dropped her sats down to about 90% and they have been sitting at 97%, so it was significant. So, they didn't pick up much so I changed the sats probe to see if there was any problem with her perfusion but it didn't improve, so I did a blood gas and it showed that her PaO<sub>2</sub> was 8.7kPa. So, at that point I increased her oxygen. And that didn't have much effect either. At the same time, her arterial line stopped working so I couldn't take another blood gas to check. So when the doctors came round I asked them what they would like to do with her ventilation, do they want me to keep increasing her oxygen or actually look at the mode of ventilation she is on to try to improve things. So, they changed her on to BiPAP which she is on at the moment. [Patient 1]*

and in case of extubation

*CK: And...who made the decision to extubate him?*

*Nurse D: We all thought that he was going to be extubated, and then the consultant came round and decided that there was no reason to wait, we shouldn't put it off until later on, it should be done straight away, which I would have thought it would be the case anyway, so I was happy to do that. So, we just extubated him. He wanted the tube out; he was awake enough for it [...]. [Patient 2]*

To conclude this section, it should be mentioned that all thirteen nurses, who were asked to reflect on their decisions while managing the weaning of their patient, validated the attributes and concepts to increase their link to the hypothesis made.

When ambiguity of the value of the attribute or of the generated hypothesis emerged, they searched for a direct validation by re-checking the value of the specific attribute in the most immediate way. Direct validation of an attribute led to more certain decisions being made, whereas indirect validation, such as a value of an equivocal attribute that caused more ambiguity led to testing of the hypothesis by trial and error or by consensus of the medical staff. Trial and error behaviours provided more information that was considered to generate another hypothesis. Illustration of such behaviours will be discussed in chapter seven. The next section analyses the strategies nurses adopted to attain the concepts regarding weaning and inform their behaviour.

## **6.6 STRATEGIES USED IN THE ATTAINMENT OF CONCEPTS RELATED TO THE ASSESSMENT AND MANAGEMENT OF WEANING FROM MECHANICAL VENTILATION**

According to the concept attainment theory, nurses obtained information appropriate to their inquiry through monitoring of the patient. They processed this information by attaching various attributes that helped them attain one or more of the concepts described earlier and generated hypotheses that linked those attributes or concepts together. They, then, evaluated the hypotheses so as to make a decision about the management of the patient's breathing. Nurses adopted various strategies to process the appropriate information, which are summarised in four distinct approaches based on Bruner, Goodnow and Austin (1956) categorisation, as explained in chapter three (section 3.2). These strategies informed nurses' clinical behaviour and approach to weaning, which is analysed in the next chapter.

A similarity of Scottish and Greek nurses' thinking was that they used a focusing strategy rather than a scanning strategy to conceptualise the attributes obtained from observation and make a decision. An exception was the emergency situation that a Greek nurse faced, when the patient was on a weaning phase but suddenly deteriorated.

In that case (Appendix 6.1, concept map K), the nurse used a Simultaneous Scanning strategy to deduce a number of hypotheses that she carried in memory and eliminated when she obtained more information. For instance, the hypotheses of lung consolidation and reduced airway patency were generated simultaneously, but they both led to the decision to manually ventilate the patient, since the patient was not able to breathe through the ventilator. A decision to change the tracheostomy tube responded to the hypothesis of reduced airway patency, thereby eliminating it from ongoing assessment and management and increased the prevalence of the hypothesis that lung consolidation caused the inability of the patient to breathe.

Table 6.7, below, demonstrates the strategies that both Scottish and Greek nurses used to process the information available to inform their hypotheses about the

patients' assessment and management of weaning. From the Scottish participants, nurse A and B looked after a patient who was on a pre-weaning phase (concept maps A and B), whereas nurses C, E, F and G a patient on a weaning phase (concept maps C, E, F and G). Nurses D and H looked after a patient who was in transition on a SBT (concept maps D and H). From the Greek participants, nurses I, J and L looked after a patient on a weaning phase (concept maps I, J and L), whereas nurse M a patient who sustained a SBT (concept map M). None of the nurses, from both samples used a Successive Scanning strategy.

| Setting               | Nurse   | Strategy              |
|-----------------------|---------|-----------------------|
| Scottish participants | Nurse A | Conservative Focusing |
|                       | Nurse B | Focus Gambling        |
|                       | Nurse C | Conservative Focusing |
|                       | Nurse D | Focus Gambling        |
|                       | Nurse E | Focus Gambling        |
|                       | Nurse F | Conservative Focusing |
|                       | Nurse G | Conservative Focusing |
|                       | Nurse H | Conservative Focusing |
| Greek participants    | Nurse I | Conservative Focusing |
|                       | Nurse J | Conservative Focusing |
|                       | Nurse K | Simultaneous Scanning |
|                       | Nurse L | Conservative Focusing |
|                       | Nurse M | Focus Gambling        |

**Table 6.7 Strategies of concept attainment used by Scottish and Greek nurses**

Nurses found a positive attribute to use as a focus and confirmed the concept of a weanable patient and developed a hypothesis that centred on the focus attribute. Then, in most cases, each choice they made changed a single attribute value of the first focus based on positive or negative values. In some cases, nurses changed more than one attribute at a time. An example is illustrated below.

*Nurse D: Well, I came on and he had been on CPAP since yesterday, since the afternoon yesterday, and his respiratory rate was stable, so I presumed that he was for extubation but he had a bit of a wheeze, so I thought I'd give him some salbutamol nebs. He was also on propofol at 10ml/h and Alfentanil and he was quite awake, so I thought I'd leave him on that while he was ready to extubate. So, I didn't take that off. And when the doctor reviewed him, he wanted him to stay intubated until his wheeze has settled, but then the consultant overheard that so we just*

*extubated him just after 10:30 am this morning. Just because his PaO2 was fine, his volumes, his respiratory rate, everything was settled and he managed on CPAP for a long period of time, he was pyrexial but that was not new, so they didn't see any reason for him to remain intubated. He is day 10 as well and he was still tubed, so either he was going to be extubated or we would have to think about doing a tracheostomy. Obviously that didn't seem necessary at all. [Patient 2]*

In most cases that the nurse aimed to reduce the ventilatory support, collected data were limited to three main concepts; gas exchange, WOB and level of consciousness. A change of one attribute value affected attributes descriptive of different concepts, which were all linked together to instigate the decision for further reduction of the ventilatory support, as shown in the example below.

*Nurse F: I think the decision to keep things pretty much the same was fine. Obviously turning the sedation off for a while was probably a good idea because he had been dependent of some noradrenaline for his blood pressure. Now that his sedation is off, his blood pressure has come back and he doesn't need it any more, so that's a good thing. Also, his tidal volumes weren't that great even though he is on quite a lot of support, and that was part of the sedation level. So we turned the sedation down to see what was going to happen and the tidal volumes haven't really improved. So, he is comfortable at the moment but if he starts becoming more agitated again we will restart his sedation at the rate it was before. He has not really achieved anything and we do not want him uncomfortable. It was worth trying to see if it was going to bring the tidal volumes up but it has not made any difference. [Patient 6]*

The Conservative Focusing strategy was the preferred approach for categorising attributes to concepts and linking the attributes and concepts to the hypotheses generated. Nurses used a safe method that guaranteed that new attributes would inform their choice, although they did not always achieve the maximum information available. Nurses who used this strategy changed a single attribute of the focus concept, which led, usually, to a stepwise approach of making a choice. The four nurses who used a Focus Gambling strategy changed multiple attribute values of the focus concept at a time, and arrived at a trial and error approach more quickly. In both Focus Gambling and Conservative Focusing strategies nurses tested their hypotheses directly to decrease the complexity and abstractness of the task. Finally,

the Simultaneous Scanning strategy was used in the case of an emergency situation when the nurse had to generate different hypotheses at the same time and test them simultaneously to reach the one that would inform further choice.

## 6.7 CONCLUSION

This chapter focused on the exploration of critical care nurses' thinking process when managing a weaning patient. Analysis of the concept maps revealed that nurses in both settings used a variety of attributes to form and attain concepts that related to the patient's breathing effort and ability to wean, with the most frequently used the adequate gas exchange and work of breathing. Most attributes were numerical, and nurses emphasized these numbers to decide on the next steps of the patient's weaning trajectory. These numbers were derived from monitors and clinical tests, but had a significant meaning attached to the concepts that nurses attained.

Attributes clustered together formed concepts, which when also clustered together generated hypotheses; in turn other concepts were developed and linked with these hypotheses. These concepts with their attributes were linked in various ways so as to formulate a hypothesis that would inform a decision regarding the patient's weaning. Nurses always generated at least one hypothesis which they validated with various methods. In most cases validation of the hypothesis resulted in decisions about adjustment of the ventilatory support, management of sedation and practice of physiotherapy, which would facilitate the patient's weaning process.

It appeared that nurses applied conservative strategies to attain the concepts of weaning that led either to further assessment of the patient or to adjustment of the ventilatory settings. The information received from assessment was processed in order to inform a clinical decision. The decisions made as an outcome of these cognitive processes were observed during fieldwork and recorded in fieldnotes. These decisions were a manifestation of nurses' clinical behaviour and defined the patients' weaning progress. The next chapter analyses the outcome of these decisions in the form of weaning approaches followed by the nurses in each patient case throughout the weaning trajectory.

## CHAPTER SEVEN

# PRACTISING THE WEANING JOURNEY



## CHAPTER SEVEN

### PRACTISING THE WEANING JOURNEY

#### 7.0 INTRODUCTION

The previous chapter analysed nurses' thinking processes when assessing and managing a weaning patient and illustrated the manner in which they attained concepts and formed hypotheses about the patients' breathing so as to address this task. These hypotheses resulted in decisions about the adjustment of the ventilatory settings, the management of sedation, and physiotherapy care. This chapter continues the analysis of nurses' decision-making by focusing on the way they implemented their thinking in practice when managing patients' weaning.

The focal point of the first section is to present the typology of the decisions made in relation to the weaning process of the selected patient cases in both settings, as derived from the thematic analysis of fieldnotes and interviews. The two themes that best described nurses' behaviour were '*wean as able*', and '*maintain a balance*'. Each theme incorporated decisions about the management of patients in real practice and integrated the concepts that nurses attained through their cognitive process.

The '*wean as able*' theme pictured the approaches used to adjust the ventilatory support on each patient until liberation from mechanical ventilatory support. It demonstrated that key decisions relative to the initiation of the weaning process, the change of mode of ventilation, the decision to perform a trial of spontaneous breathing (SBT) and the decision to extubate a patient were medical. Decisions about the adjustment of the ventilatory settings were initiated with the medical instruction '*wean as able*' and depended on nurses' interpretation of this instruction and the level of competence and autonomy in making weaning decisions. The diversity in nurses' interpretation and clinical behaviour led to a variety of weaning patterns followed for its patient. Although in both settings there was an implemented weaning protocol to facilitate these decisions, it was not observed to be used. More

information about the role of the weaning protocol and its influence in nurses' behaviour is presented in chapter eight. However, both Scottish and Greek nurses demonstrated a holistic approach to the management of the weaning patient, as described by the theme '*maintain a balance*'.

## **7.1 THEMES AS DESCRIPTIVE OF NURSES' BEHAVIOUR WHEN WEANING A PATIENT**

The attainment of concepts by nurses, as described in the previous chapter, aimed to solve a problem, the reliance of the patient on mechanical ventilation. In order to achieve this task various hypotheses were proposed which were explored and altered to make sense of the arbitrary stream of events that occurred throughout the weaning trajectory. As explained in the previous chapter, most nurses followed a focusing strategy to attain and validate the hypotheses made. These hypotheses were the outcome of processing the concepts attained and resulted in adjustments of the ventilatory settings, the management of sedation and the practice of physiotherapy, starting from the pre-weaning phase to the liberation from the ventilator.

Nurses' behaviour was captured in two main themes. The theme '*wean as able*' depicted the decisions made when adjusting the ventilatory settings during the weaning process of the patient. Such decisions involved hypotheses about the patient's ability to initiate weaning, to sustain reductions of the ventilatory support and trials of spontaneous breathing and to the patient's ability to extubate. The theme '*maintain a balance*' portrayed decisions in relation to the management of sedation of the patient and the practice of physiotherapy.

Nurses' behaviour when adjusting the ventilatory settings was quantitatively presented with the use of the Decision Episode Tool (DET). In the Scottish sample, 427 decisions concerned adjustments of the ventilatory settings in all the patient cases observed. While nurses made 273 (63.93%) decisions, doctors 143 (33.48%), only 11 (2.57%) were collaborative decisions (Table 7.1).

| <b>Total number of decisions on...</b> | <b>Doctor<br/>N (%)</b> | <b>Nurse<br/>N (%)</b> | <b>Collaborative<br/>N (%)</b> |
|--|-------------------------|------------------------|--------------------------------|
| Adjusting the mode of ventilation      | 43 (10.07)              | 49 (11.47)             | 3 (0.7)                        |
| Adjusting the PS                       | 23 (5.38)               | 75 (17.56)             | 1 (0.23)                       |
| Adjusting the PEEP                     | 11 (2.57)               | 20 (4.68)              | 0                              |
| Adjusting the FiO2                     | 1 (0.23)                | 53 (12.41)             | 0                              |
| Initiate weaning                       | 47 (11)                 | 34 (7.96)              | 5 (1.17)                       |
| Extubation or performing SBT           | 21 (4.91)               | 11 (2.57)              | 2 (0.46)                       |
| Who extubated or performed SBT         | 0                       | 31 (7.25)              | 0                              |
| <b>Total</b>                           | <b>143 (33.48)</b>      | <b>273 (63.93)</b>     | <b>11 (2.57)</b>               |

**Table 7.1 Content of decisions made by the Scottish clinicians**

In the Greek sample, 636 decisions were observed from all the cases during this period. Four hundred ninety eight (78.3%) decision episodes were exclusively medical and 136 (21.38%) were made by nurses. Only 2 (0.31%) decision episodes were made collaboratively (Table 7.2). From the decisions that Greek nurses made, the most prevalent was the adjustment of the level of oxygen (FiO2) on the ventilator and less frequently the decisions to initiate weaning, to extubate and change the mode of ventilation.

| <b>Total number of decisions on...</b> | <b>Doctor<br/>N (%)</b> | <b>Nurse<br/>N (%)</b> | <b>Collaborative<br/>N (%)</b> |
|--|-------------------------|------------------------|--------------------------------|
| Adjusting the mode of ventilation      | 111 (17.45)             | 9 (1.41)               | 0                              |
| Adjusting the PS                       | 161 (25.31)             | 29 (4.55)              | 1 (0.15)                       |
| Adjusting the PEEP                     | 82 (12.89)              | 25 (3.93)              | 1 (0.15)                       |
| Adjusting the FiO2                     | 20 (3.14)               | 49 (7.7)               | 0                              |
| Initiate weaning                       | 99 (15.5)               | 11 (1.72)              | 0                              |
| Extubation or performing SBT           | 17 (2.67)               | 2 (0.31)               | 0                              |
| Who extubated or performed SBT         | 8 (1.25)                | 11 (1.72)              | 0                              |
| <b>Total</b>                           | <b>498 (78.3)</b>       | <b>136 (21.38)</b>     | <b>2 (0.31)</b>                |

**Table 7.2 Content of decisions made by clinicians in the Greek setting**

## 7.2 WEAN AS ABLE

The theme 'wean as able' reflected the decisions made on adjusting the ventilatory settings. The phrase 'wean as able' derived from doctors' instructions to wean the ventilatory support as far as the patient tolerated it. Scottish doctors directed nurses by documenting this on the medical notes. Greek doctors directed nurses solely verbally. Despite the existence of a weaning protocol, the weaning approaches followed were based on this instruction. The 'wean as able' did not provide any significant plan about how and to what extent the ventilatory support should be reduced or the achievable goal for weaning. Consequently, nurses interpreted it differently, depending on their knowledge and competence in managing the ventilator. Each adjustment was based on their judgment and process of information received from assessing the patient. This is illustrated in the excerpt below by a Scottish nurse.

*Wean as able. It is so, so vague. It doesn't say, ok, I want to drop the pressure support by 10cmH2O in the next 12 hours or likewise, overnight I want you to put them on 10 over 5, or 25 over 8cmH2O. They don't really say, they just say wean as able. So, it is kind of left on your own discretion. [Interview with nurse Marion, Scotland]*

The steps for weaning the patient off the ventilator were similar in both settings and were well explained by the doctor below.

*With the new ventilators we can use different modes of ventilation, and when the patient is sedated with high doses so that he does not breathe spontaneously, he is on a full support model. Then we have different types of modes of assisted breathing available, which are modes that give mandatory breaths to the patient but allow the patient to take spontaneous breaths as well. We can use these modes when we have a haemodynamically stable patient. Reducing the sedation gradually, when the safety time period that he needs to stay sedated depending on his condition, has passed....each patient needs his own time to start breathing himself, then we put him on an intermediate mode of support. We assess how he copes on that...There are some criteria to put him on such a mode and what you observe afterwards. Then if we see that he tolerates that, we start reducing the support from the ventilator more. As we reduce the support from the ventilator his participation in breathing increases. When he is ready to go on to spontaneous breathing, I mean to*

*a mode in which the patient breathes himself but receives some support from the ventilator, then we gradually reduce this support until we are able to put him on a T-piece trial, which means that he is disconnected from the ventilator and he takes only oxygen if he needs it. We then check a blood gas after half an hour, we assess all the parameters and his clinical condition and blood gases, his vital signs and we can say that he passed the trial if he remains haemodynamically stable, when he does not use his abdominal muscles to breathe, when he is not tachypnoec and short of breath, and his blood gases are satisfying with no signs of hypoxia. If we have a chronic hypercapnic patient, we will accept some hypercapnea in the levels that the patient has normally. If he is successful, we remove the endotracheal tube, supporting the patient psychologically at the same time. [Interview with doctor Chris, Greece]*

The excerpt above gives a full description of the weaning process and highlights the main decisions that are relevant throughout the process. How the ‘*wean as able*’ was interpreted into practice became obvious when I analysed the particular decisions and the weaning patterns of each patient case, in both settings, throughout the weaning continuum.

#### 7.2.1 DECISION TO INITIATE WEANING

The decision to initiate weaning was predominantly doctor-led in both settings. Both Scottish and Greek doctors made this decision at the ward round. This decision involved the reduction of sedation to a certain level that would allow the patient to take spontaneous breaths, and subsequently the change of the mode of ventilation from a mandatory mode to an assisted spontaneous mode, on which patient’s participation was significant.

Although the decision to initiate weaning was doctor-led, nurses processed the information they received from observation to identify the ability of the patient to start weaning. They selected attributes that described the concepts of adequate gas exchange, of the level of consciousness, of the physiological criteria, such as cardiovascular stability and resolving underlying condition and made the hypothesis that the patient could tolerate a change from mandatory mode of ventilation to an assisted spontaneous mode. Nurses used a focusing strategy to incorporate all the

information they gathered to confirm their hypothesis. The excerpt below demonstrates this.

*They (the doctors) often make a decision when it is time to flip between one mode and another, from SIMV to ASB; so, the medical plan would be to wean them to ASB, when that is appropriate, and the nurse will monitor the patient and take it upon herself to flip them on the other mode of ventilation. So, we often do that. I think we should have the confidence to be able to reduce the pressure support and of course their oxygen based on blood gas analysis in particular and the saturation monitoring. We should have the confidence to reduce the FiO2 [...] In patients where there would be a simple plan - and the plan was to put them from SIMV to ASB and then to reduce the ventilation - that often can be discussed in terms, if we can wean them. In more complex ventilation modes, people who have been here for a long time and who have a high ventilation requirement, high support requirement, I think that I would probably... it depends on whether we should be reducing the support, it would depend on what level of support they are on. For example, somebody who is on 100% BiPAP, 24 breaths, a large pressure support by a large PEEP, and looked as though there was room to wean, I would take that, as everything else that is going on with the patient, ... it would be appropriate for us to wean the ventilation and maybe to pass that on to the medical staff as well. [Interview with nurse John, Scotland]*

The phrase quoted above ‘*looked as though there was room to wean*’ incorporated a process of clustering attributes that confirmed the hypothesis that the patient was able to sustain the change of the mode of ventilation. However, when the decision to change the mode of ventilation from mandatory to an assisted spontaneous mode resulted in the patient’s deterioration, nurses revised the initial hypothesis that the patient would tolerate this change and changed the mode back to the previous mandatory one. Laboured breathing pattern, worsening gas exchange and distress were considered negative confirming instances of the initial hypothesis that the patient was able to wean. Both Scottish and Greek nurses’ assessment of the patient led to the attainment of the concept of ‘*weanable patient*’ and defined the decisions to adjust the ventilatory settings.

### 7.2.2 DECISION TO ADJUST VENTILATORY SUPPORT

Alterations to the ventilatory support were relevant to the decisions to change the level of FiO<sub>2</sub>, the level of Pressure Support (PS), and the level of Positive End Expiratory Pressure (PEEP). Doctors did not provide any precise weaning plan for the patient. In a few cases, mainly in the Scottish sample, doctors prescribed thresholds for some attributes, which nurses used to base their decisions on. Such attributes were the level of PaO<sub>2</sub>, PaCO<sub>2</sub>, respiratory rate and SpO<sub>2</sub>. Nurses used these parameters when they iterated and altered the concepts of acceptable gas exchange, WOB and confirmed the hypothesis that the patient was able to wean, and therefore, proceeded to reductions of ventilatory support. Greek doctors also gave such thresholds, but these were communicated verbally to nurses and were never documented.

Another medical instruction was to ‘*rest overnight*’ without giving ‘*any specific goals*’. Such unspecified instructions permitted the use of trial and error behaviours when adjusting the ventilatory settings according to nurses’ clinical judgment.

*But I think weaning is more like trial and error isn't it? It's very much of...If observations are ok you can manage to titrate things down, and if it doesn't work increase it and if it does work, then great. [Interview with nurse Gordon, Scotland]*

It was interesting to observe that both Scottish and Greek nurses consulted the medical staff before adjusting the ventilatory settings, in particular the level of PS and PEEP. In both settings, nurses appeared to be confident in adjusting the level of oxygen (FiO<sub>2</sub>), but they did not show the same degree of confidence when they adjusted the level of PS and PEEP. In the Greek setting, very few nurses adjusted the level of PS and PEEP, despite the fact that they processed the information gained from assessment. Scottish nurses, on the other hand, were more active in making changes of the PS and PEEP, but always referred to the medical staff. In cases of uncertainty about how to proceed, both Scottish and Greek nurses sought medical advice, regardless of their level of experience. This behaviour was relevant to the



level of responsibility and accountability that nurses took for making such decisions. Further discussion on this matter follows in chapter eight.

What described Scottish and Greek nurses' behaviour while weaning the patient's ventilatory support was that they used a conservative approach, as illustrated in the reflective interview with Nurse F.

*CK: So how did you decide how much to reduce the Pressure Support (PS) because then you stopped weaning him so I was wondering why that was?*

*Nurse F: I felt that he was comfortable at this point, his saturation was sitting on...he had been on 99% earlier on, going down to 96. His PaO<sub>2</sub> was still good and his PaCO<sub>2</sub> was alright as well, so if he hadn't been going to CT scanning, I would probably have gone another a little bit down. But because I am new to weaning I generally tend to go smaller steps at the time rather than reducing it by a large amount of pressure. And I didn't want to overdo it, because we've gone from something similar yesterday, where he started of 25 over 5, he has gone down to PS of 17 over 5. And then, he was fine until the middle of the night, and then he had a seizure. So I didn't want to go too hard on him. And he is not getting much up off his chest. I mean his lactate has been steady, pretty steady all along, 1.3, 1.4, 1.2. You know he is not working too hard. [Patient 6]*

The nurse above used information from clinical assessment and from previous knowledge of the patient to decide on the level of adjustment of the ventilatory support. She used a trial and error behaviour based on her intuitive judgment to make small and gradual changes of the PS level. Nurses were observed to reduce the PS gradually, by 2 to 5cmH<sub>2</sub>O, every two to three hours and confirmed their initial hypothesis that the patient was able to sustain reductions of ventilatory support with new information they received from frequent blood gas analysis, observation of the tidal volumes, respiratory rate and SpO<sub>2</sub>. In the case where the attributes of WOB and gas exchange confirmed the hypothesis that the patient was weanable, nurses continued reducing the ventilatory support until the lowest level of support that the patient could tolerate, before attempting a trial of spontaneous breathing.

When there was an increase of the PaCO<sub>2</sub> or reduction of the tidal volume and increase of the respiratory rate that signified respiratory fatigue, nurses tended to

increase the PS by 2 to 5cmH<sub>2</sub>O as a response to a positive confirming contingency that described respiratory fatigue. They, then, changed their hypothesis that the patient would not tolerate any further reduction of the ventilatory support.

In many cases, it was observed that the patients did not sustain reduction of ventilatory support for a period of more than two days, while being already on a weaning phase. These periods differed amongst patients and occurred either at the beginning of the weaning process, or after the patients sustained trials of spontaneous breathing. Weaning inactivity that occurred at the onset of the weaning phase was due to the fact that the patient could not tolerate significant changes of the ventilatory support, such as in cases 4, 5, 13 and 17.

For instance, one of the nurses, who looked after patient 2, explained the reasons for not proceeding with the patient's weaning. Lung consolidation, increased amount of secretions, hypoxia as assessed from blood gas analysis, episodes of desaturation and increased respiratory rate signified that the patient was not able to sustain any reduction of ventilatory support.

Weaning inactivity was also observed when a trial of spontaneous breathing was implemented prematurely. The excerpt from fieldnotes below is a characteristic example. In this case, the patient was on high level of PEEP, 10cmH<sub>2</sub>O, and FiO<sub>2</sub> 0.8, and the doctor decided to use a speaking valve (Passy Muir Valve).

*The doctors have decided at the ward round to try him on the PMV although he has been on high PEEP. The nurse had a look at the 24-hour chart from yesterday and the day before and saw that he (the patient) already had a trial on the PMV. The first time it was for 10 minutes and then he desaturated so he had to be connected to the ventilator. The next day the patient lasted for 1 hour and 15 minutes on the PMV before he desaturated. I asked the nurse what she would do with the patient's weaning. She said that she was not going to put him on the PMV because she thought that his condition and the fact that he was on so much PEEP was not an indication for a trial on the speaking valve, since this would distress him more. She did not agree with the doctor's suggestion and she said that she would try to reduce the PEEP by 1cmH<sub>2</sub>O later. She was not going to change the FiO<sub>2</sub> at the moment judging from the blood gases. [Fieldnotes, Patient 9, Scotland]*

In the case that the patient did not respond well to the reduction in the ventilatory support, which was usually apparent with respiratory distress and fatigue (signs of desaturation, agitation, worsening blood gases or cardiovascular instability), the nurses were reluctant to proceed with any further changes. Positive confirming instances of respiratory fatigue were the increased level of PaCO<sub>2</sub> and increased respiratory rate, more than the acceptable prescribed thresholds and the use of accessory muscles. When the use of accessory muscles was not always obvious but there was increase of PaCO<sub>2</sub> and respiratory rate, this was considered as a positive infirming instance of respiratory fatigue. When the PaCO<sub>2</sub> level was normal but there was apparent use of accessory muscles of breathing, this was considered a negative infirming instance. Such cases resulted usually in increasing the ventilatory support.

Observation revealed that abrupt changes of the ventilatory settings were implemented exclusively by the medical staff (raw data are presented in Appendix 7.3). Nurses characterised an approach to weaning as abrupt or aggressive when reductions of PS and PEEP more than 10cmH<sub>2</sub>O occurred within 1 hour, or when SBT happened while the patient required high levels of ventilatory support (more than 20cmH<sub>2</sub>O) and oxygen (FiO<sub>2</sub> more than 0.6). In the particular case, above, the experienced nurse disagreed with the doctor's suggestion to put the patient on speaking valve (PMV) and did not follow his order, because she judged that the patient was not ready to tolerate such a change. However, not all nurses behaved in the same manner. Less confident nurses would follow the doctor's order, despite the fact that they did not agree with. The reasons of such behaviour will be explained in the next chapter.

### 7.2.3 DECISION TO SUSTAIN A SPONTANEOUS BREATHING TRIAL

The decision to try spontaneous breathing was doctor-led. Patients, who were weaned via an endotracheal tube, underwent a trial with CPAP of 5cmH<sub>2</sub>O. The usual method for a trial for the patients with a tracheostomy was T-piece, or

combinations of T-piece and CPAP 5cmH<sub>2</sub>O, or T-piece and speaking valve. In most cases, a SBT was performed when the PEEP was less than 7cmH<sub>2</sub>O. However, in case 17 of the Greek sample and case 9 of the Scottish sample a trial of spontaneous breathing was performed when the PEEP was 10cmH<sub>2</sub>O. In both cases, the decision was doctor-led and was based on the indication that the patient was alert and had acceptable levels of blood gases on pressure support ventilation (PSV). Examples of doctors' aggressive weaning behaviour are illustrated in Appendix 7.3.

Both Scottish and Greek nurses suggested trials of spontaneous breathing after assessing the patient, but their implementation was always medical driven. To instigate that decision nurses focussed on attributes related to adequate gas exchange, as assessed from blood gas analysis, and WOB, as indicated by the respiratory rate and tidal volumes, while the patient was on low ventilatory support, such as PS 5cmH<sub>2</sub>O and PEEP 5cmH<sub>2</sub>O. They also evaluated other parameters such as the level of alertness and sedation level, the ability to cough, and the amount of secretions.

Nurses assessed the above attributes, also, after the implementation of the trial, and if the values were within acceptable parameters, their hypothesis was confirmed. If some of the values, in particular the PaO<sub>2</sub>, PaCO<sub>2</sub>, SpO<sub>2</sub>, and respiratory rate changed significantly, the attributes were considered negative and the hypothesis was altered. A nullified hypothesis resulted in changing the mode of ventilation to provide increased ventilatory support. The excerpt from fieldnotes from patient case 16 of the Greek sample illustrates a confirming hypothesis.

*The nurse took over the patient with PS 7cmH<sub>2</sub>O and PEEP 7cmH<sub>2</sub>O. She said that she weaned him to PS 5cmH<sub>2</sub>O and PEEP 5cmH<sub>2</sub>O at 10:00 based on his clinical condition and his blood gases. The patient was getting Vt: 450ml and f: 24bpm and was on FiO<sub>2</sub>: 0.4. His blood gas was PH: 7.54, PaO<sub>2</sub>: 12.1kPa, PaCO<sub>2</sub>:4.25kPa and SpO<sub>2</sub>: 98%. The nurse stopped the Ultiva at 11:00. Then the nurse put him on T-piece for 15 minutes to have a trial off the ventilator and the patient had a very good respiratory rate 22bpm, good SpO<sub>2</sub>: 98% and very strong cough.  
[Fieldnotes, Patient 16, Greece]*

The excerpt below, on the other hand, illustrates a nullified hypothesis.

*At the medical ward round it was pointed that the oxygen requirements have increased over the last few days and that the patient will need a tracheostomy at some point. They (the doctors) decided to change the ventilation again to CPAP 7cmH2O. The patient remained on CPAP for 1 hour. However, the patient desaturated and the nurse checked a blood gas, which showed that the PaO2 was 8kPa and PaCO2 was 6.2kPa on 80% oxygen. The nurse put the patient back to PSV with pressure support 15cmH2O and PEEP of 10. [Fieldnotes, Patient 1, Scotland]*

#### 7.2.4 DECISION TO EXTUBATE THE PATIENT

The decision to extubate a patient was exclusively doctor-led. In patient cases 2, 3, 14, and 16 extubation proved to be successful, whereas in cases 5, 6, 10 and 11 was unsuccessful and resulted in re-intubation and tracheostomy formation. When Scottish nurses had medical approval to extubate the patient, they, independently, proceeded to removing the endotracheal tube. However, in the Greek setting, only one nurse was observed to independently extubate the patient after the decision was made at the ward round.

It was interesting to explore the cases of extubation trials and the strategies that were used. Analysis of the reflective interviews revealed that in all cases that an extubation trial was unsuccessful a Conservative Focusing strategy was used, whereas in the cases of successful extubation, both a Focus Gambling and Conservative Focusing strategy was applied.

Nurse H who looked after that patient on the day of extubation used a Conservative Focusing strategy to make the hypothesis that the patient was able to extubate. The nurse selected instances of positive attributes that confirmed the hypothesis that the patient was ready to be extubated. Such confirming attributes were that the patient was awake and cooperative and that he could take tidal volumes of 400ml given the fact that he was ventilated with CPAP of 5cmH2O. These were positive confirming attributes of the hypothesis that the patient was weanable and ready to be extubated. A PaO2 of 10kPa was considered to be a positive attribute which the nurse compared with previous values derived from blood gas analysis. However, the nurse assessed

the level of PaO<sub>2</sub>/FiO<sub>2</sub>, which was below the acceptable threshold level; this attribute acted as negative information for affirming the initial hypothesis. Another attribute that offered negative information to confirm the hypothesis of extubation was the increased amount of secretions. Negative information usually created uncertainty for the nurse to make an independent decision to extubate the patient. This uncertainty was resolved by gaining medical approval to proceed to extubation. The decision made, in that case, was to withhold the extubation for the following day until these two parameters improved.

By contrast, the experienced nurse M who looked after patient 16 from the Greek sample used a Focus Gambling strategy to arrive at the hypothesis that the patient was ready for extubation. The nurse collected a few positive instances of the gas exchange, the WOB and the level of alertness, given the current ventilatory settings and the progress of the patient the last 24 hours. These were combined with the physiological attribute of distended abdomen. The latter attribute had been a barrier to the reduction of ventilatory support at the onset of the patient's weaning.

The hypothesis made at this stage was that the patient could tolerate a trial with T-piece. The positive instance of tolerating a trial became the focal attribute on which the nurse based a new hypothesis that the patient was ready for extubation. New positive attributes were added to evaluate the new hypothesis, such as strong cough reflex, minimal amount of secretions, patient cooperative and being alert, PaO<sub>2</sub> more than 12kPa, which confirmed the hypothesis. Again, consultation with the medical staff was necessary and resulted in extubating the patient successfully.

These two examples demonstrated that focusing strategies, either conservative or Focus Gambling were used to attain the concept that the patient was ready to be extubated. The findings could not support the superiority of these decision-making strategies in the decision to extubate mechanically ventilated patients, but they illustrated that focusing strategies reduced the mental strain by attaining a focal concept and testing the hypotheses generated directly; thus reducing the complexity of making this decision.

#### 7.2.5 DECISION REGARDING A TRACHEOSTOMY FORMATION

The decision to do a tracheostomy was doctor-led in both samples. It depended on the patients' progress in weaning and their endurance of a trial of spontaneous breathing. Patients who had a failed extubation were candidates for a tracheostomy formation to facilitate their weaning.

The threshold time for a tracheostomy formation differed among patients. In the Scottish sample, eight out of ten patients received a tracheotomy on day nine after intubation (median value: 9, IQR: 7). On the contrary, six out of nine Greek patients received a tracheotomy on day five (median: 5, IQR: 10). Patient 7 and 8 from the Scottish sample had an early tracheostomy, because their level of consciousness remained low after cessation of sedation, which did not allow their participation in spontaneous breathing and consequently further reduction of ventilatory support. Patients 4, 10 and 11 spent a prolonged period of ventilation via an endotracheal tube, with 19, 17 and 13 days respectively, before the decision for a tracheostomy was made.

Nurses referred to the reasons of a tracheostomy formation during their interviews. A significant criterion was the patient's neurological behaviour. Patients who were agitated when the sedation was reduced and were not able to synchronise with the ventilator, became easily tachypnoeic, hypertensive and tachycardic, were considered candidates for a tracheostomy. High levels of PEEP and FiO<sub>2</sub> were a barrier for a tracheostomy formation. In the case that the patients were in need for increased levels of oxygen supply and became hypoxic, the clinicians postponed the tracheostomy formation until the patients' breathing condition improved.

These sections illustrated nurses' interpretation of the '*wean as able*' medical instruction into clinical practice which defined the weaning pattern followed for each patient case. Four key points characterised nurses' behaviour. First, key decisions relative to the initiation of the weaning process, the performance of a trial of spontaneous breathing, the decision to extubate the patient and the decision to perform a tracheostomy formation were predominantly doctor-led. Second, nurses'

involvement was limited to the assessment of the patients' ability to sustain these interventions. Scottish nurses were observed to instigate these decisions more frequently than their Greek colleagues. However, in both settings, nurses' demonstrated a critical role in processing and interpreting information.

Third, once the medical decision to initiate weaning was made, nurses were more involved in adjusting the ventilatory settings. Nurses followed a conservative approach to make small changes of the ventilatory settings, in comparison to medical staff who presented to be more aggressive. The use of focusing decision-making strategies facilitated the use of information from assessment to judge the patients' ability to sustain any reduction of ventilatory support. However, how much nurses adjusted the ventilatory support depended on their clinical judgment since there was no dedicated and specific weaning plan that would define the weaning approach.

Forth, nurses' clinical behaviour was limited to small, subtle changes of the ventilatory settings. Nurses showed a passive role in adjusting the level of ventilatory support and were more confident in making changes of the level of oxygen independently rather than the level of PS, PEEP or mode of ventilation. Their level of involvement depended on factors relative to the clinical environment and their perceived clinical role, which are discussed in chapter eight. Clearly, clinical behaviour during the weaning trajectory had a consequence on the weaning patterns followed in each patient case. These weaning patterns are discussed below.



### 7.3 WEANING PATTERNS

To present the weaning trajectory of the patients from the Scottish and Greek settings, the process was divided into three stages: the pre-weaning phase, when the patient was ventilated with a mandatory mode of ventilation; the weaning phase when the patient was ventilated with an assisted spontaneous breathing mode; and the final stage when the patient had trials of spontaneous breathing without any assistance from the ventilator. The main decisions made during the three phases were described before.

The ventilatory settings were recorded during observation throughout the patients' weaning journey. The Adjustment of Ventilator Tool (AVT) facilitated this process. Recordings were then inserted in an Excel file, as mentioned in chapter four, for analysis, and were then used to create graphs that would illustrate patients' weaning progress during the observation period. An example of the graphical presentation of the weaning progress of patient cases 10 and 12 is presented in Appendix 7.1. From the graphs, the patterns of weaning that each patient followed were summarized and are presented in Appendix 7.2.

Each patient's weaning was managed differently. However, there were some commonalities in the weaning patterns followed.

Firstly, a mandatory ventilation mode, either BIPAP or SIMV, was used during the pre-weaning phase. The initiation of the weaning process started with the change of the mode of ventilation from mandatory to Assisted Spontaneous Breathing (ASB) in all patient cases.

Secondly, two patterns of adjusting the pressure support were apparent: a gradual reduction of pressure support; meaning the reduction of the level of support by 2 to 5cmH<sub>2</sub>O within a period of 2 to 10 hours; and an abrupt reduction of pressure support occurred when the level of support was reduced by more than 20% within one hour.

A plateau period was characterised by a static level of pressure support for more than two days. Some patients underwent periods of weaning inactivity more than once during their weaning process.

The level of PEEP was maintained at a low level, usually less than 10cmH<sub>2</sub>O. Changes in PEEP happened gradually, between 1 to 2cmH<sub>2</sub>O within a few hours. The lowest level of PEEP used was 5cmH<sub>2</sub>O.

Adjustments of FiO<sub>2</sub> occurred gradually, usually by 5 to 10%, throughout the weaning phase.

Spontaneous Breathing Trials (SBT) were performed with either a T-piece or a speaking valve and usually followed a trial of CPAP 5cmH<sub>2</sub>O. The SBT happened alternatively with phases of increased PS.

More variation of ventilatory values occurred when adjusting the pressure support level than when adjusting the level of oxygen.

Looking at the patients in the Scottish sample with shorter weaning periods (patients 3, 7, 8, and 10), a small increase in the level of support was obvious at the beginning of the weaning phase, and was followed by a gradual reduction in support until the patient experienced a trial of spontaneous breathing. In the Greek sample, frequent variation of pressure support occurred during the first eight days of weaning for the majority of patients. From the variation in the level of PS over time, it appears that there was a period of peak levels of PS before it was reduced.

Unlike the cases in the Scottish sample that followed a plateau period of PS, the Greek patients experienced periods of inactivity less frequently with the exception of case 17, who spent 50% of the weaning time without any reduction of ventilatory support. Frequent but small variations of the ventilatory support were observed daily with the exception of patient 17 who died and patient 14 who was extubated. The latter received a low amount of ventilatory support the first three days (60% of weaning time) and was extubated on the fifth day. Patient 11 faced a period of weaning inactivity after he had a failed extubation and re-intubation (15% of

weaning time). It was striking to observe that periods of weaning inactivity recurred not only when the patient deteriorated, but also in cases that there were no signs of deterioration. The reasons behind this practice could be related to lack of information flow as well as other socio-cultural elements of the clinical environment that did not promote shared decision-making. These are explained and analysed in the following chapter.

This section described how the '*wean as able*' instruction given by the medical staff was interpreted in the weaning patterns that each patient followed. This was important because it illustrated the diversity of the weaning approaches followed not only among patient cases, but also among nurses who looked after the same patient. The lack of adherence to the existing implemented weaning protocols in each setting and the lack of a precise weaning plan individualised to each long-term ventilated patient resulted in long periods of weaning inactivity and irregular alterations of the ventilatory support. The following section presents the second theme of '*maintaining balance*' that captured nurses' behaviour when caring for the weaning patient.

## 7.4 MAINTAIN A BALANCE

The theme '*wean as able*' illustrated nurses' interpretation of the decision to reduce the ventilatory support, which was manifested with the various weaning patterns. Another theme that was identified through analysing data from various sources was '*maintain a balance*'. Nurses' aimed to maintain a balance for the patient, which influenced the manner they adjusted the sedative drugs, the provision of physiotherapy and psychological support.

### 7.4.1 MANAGING SEDATION

A certain amount of sedative drugs was needed to maintain a safe and tranquil condition and allow the patient to cope with the illness, the machinery and the invasive procedures. The weaning trajectory commenced with the reduction of the level of sedative drugs. In both settings, the decision to reduce or stop the sedation was made at the ward round by the medical staff and signified the transition from a pre-weaning to a weaning phase. It was observed that the decision to adjust the sedation level was a component of the '*wean as able*' instruction given by the medical staff. The scope was to increase the patient's level of awareness, which was suppressed due to the sedative drugs.

Nurses were involved in the decisions to manage the sedation in both settings. In the Scottish setting, from the 137 decision episodes, 51 (37.22%) were doctor-led and 83 (60.58%) nurse-led. It is remarkable that no decision was collaborative. The majority of decisions that were doctor-led involved the decision to have a sedation hold. The implementation of that decision was made by the nurse. Nurses were observed to decide more independently about increasing the sedation rather than reducing it.

In the Greek setting, from the 182 decision episodes on the adjustment of sedation, 66.48% were doctor-led and 32.42% nurse-led. Only 1.09% of the decisions were collaborative. Doctors decided on reducing the sedation, whereas nurses implemented it in most cases. Greek nurses' input in making the decision to either increase or reduce the sedation was very limited unlike the Scottish nurses who acted

more independently. Overall, Greek nurses had limited input in making decisions but they implemented them when prompted by the medical staff.

In the Scottish setting, this decision was documented in the medical notes as '*reduce sedation*' or '*sedation hold*' and informed nurses' behaviour. In the Greek setting, the same decision was verbally communicated to the nursing staff. The time for a '*sedation hold*' differed between patients. In the Scottish setting, it occurred only in the morning, whereas in the Greek setting, it occurred also at night.

Nurses, in both settings, observed the patient's response when reducing the sedation. The assessment of the patient's neurological status informed their decisions not only about the management of sedation but also about adjusting the ventilatory support. When the patient became increasingly conscious he or she responded to different stimuli applied, such as light, noise, speech, touch, pain and was also able to take spontaneous breaths and participate in breathing. It was mentioned earlier that spontaneous breaths more than 10 per minute instigated the decision to change the mode of ventilation from mandatory to an assisted spontaneous, which implied the transition to the weaning stage.

However, the time for each patient to become alert differed, as one of the Greek doctors highlighted.

*[...] He (the patient) does not wake up immediately, he needs some time depending on his age, the failure he has, the drugs that we use which have a short half-life time. Some patients need more time than others need. [Interview with doctor Helen, Greece]*

As nurses reduced the level of sedation, the patient had different reactions. He or she would either remain calm and alert or become distressed. When the patient remained alert and calm, nurses combined the attributes of the level of consciousness with attributes that described the WOB (respiratory rate and tidal volume), and proceeded to reductions of respiratory support. On the other hand, distress was manifested with an increased heart rate and blood pressure, increased respiratory rate and laboured

breathing, desaturation (low SpO<sub>2</sub>), unintended movements in bed, and sometimes with efforts to pull the endotracheal tube out.

In some cases, nursing interventions, such as suctioning, physiotherapy or mobilisation of the patient caused distress when the sedation was stopped having an impact on the patients' WOB and consequently gas exchange. In such cases, nurses tended to induce sleep by restarting the infusion of sedative drugs or delivering small amounts of sedation intermittently. For instance, one of the nurses reported at the end of her shift that:

*The patient had two attempts on Pressure Support Ventilation but they both failed, because the patient became suddenly agitated and was fighting the ventilator requiring sedation to settle down and allow for the ventilator compliance. [Fieldnotes, Patient 2, Scotland]*

In the case above, the nurse reduced the sedative drugs and assessed the patient as he was waking up. The patient was taking spontaneous breaths, was opening his eyes, and was moving his arms when asked, but when the nurse stopped the sedation, he started coughing. The nurse noticed that the saturation of oxygen (SpO<sub>2</sub>) decreased to 88%. Based on these attributes the nurse hypothesised that the patient's reaction was due to the endotracheal tube intolerance and consequent bronchospasm. She, then, decided to inject a small amount of the sedative drug to allow the patient to relax. The hypothesis of the nurse was confirmed when the patient stopped coughing and his respiratory rate reduced to 24 bpm and the SpO<sub>2</sub> increased to 97%.

A frequent expression of the patients' conscious level, which became obvious when the sedation level was reduced or stopped, was agitation. Nurses referred to agitation as the consequence of the sedation hold when both the sedative and opioid drugs were stopped simultaneously. Nurses described a patient as agitated when he or she presented hyperactivity, combativeness or fluctuating episodes of drowsiness and inability to follow commands.

An agitated patient required an individualised approach to managing sedation. Nurses increased the sedation to allow the patient to rest, but consulted the doctors

about altering the sedation regime. One of the patients in the Greek setting, for instance, developed evidence of agitation every time the sedation was reduced and required a mixture of medicines to manage this acute mental state.

*The sedation regime that was decided by the doctors today was to stop the Diprivan, and keep the Ultiva at 2ml/h, stop the Haloperidol infusion, use Dormicum for the night to let him sleep and give Xanax again.  
[Fieldnotes, Patient 11, Greece]*

Very frequently, Scottish doctors prescribed clonidine to allow a gradual withdrawal of the sedative drugs. Haloperidol was another drug that was used in both settings to manage patients who became restless.

Nurses adjusted the level of sedation so as to maintain a balance between the patient's conscious level and ability to breathe spontaneously. They preferred to decrease the sedation gradually rather than stop it abruptly, because, as they explained, it '*enabled the patient to adjust to reduced levels of sedative drugs*'. In both settings, nurses increased the sedation to ensure adequate rest during the night. They pointed that it is better to '*keep it safe*', referring to the possibility of the patient becoming aggressive and uncooperative, putting himself or herself at risk. The Greek nurse, below, demonstrated that.

*I think it is also a balance to be sedated enough to tolerate it but not too sedated that she won't breathe herself. I don't think there is a point for her to be right awake when she is on as much as she is on, but at the same time you want to be able to wean her if we were able. [Interview with nurse Georgia, Greece]*

Scottish nurses were more inclined to increase the sedation than the Greek nurses despite the fact that they looked after only one ventilated patient, compared to their Greek counterparts who, usually, cared for two or three patients on their shift. However, patients in the Greek setting were physically restrained when their sedation was stopped so as to avoid hazardous episodes due to their hyperactivity, such as pulling out the endotracheal or tracheostomy tube, the arterial line or other invasive lines.

#### 7.4.2 PHYSIOTHERAPY

Part of nurses' activities to maintain a balance was the provision of physiotherapy. This included not only chest physiotherapy to manage copious and purulent secretions, but also mobilisation of the patient. Nurses assessed the breath sounds to arrive at various hypotheses regarding the existence or not of secretions and lung consolidation. For instance, audible crackles in auscultation precipitated a number of actions, such as suctioning and manual ventilation. The amount and quality of secretions, were considered when a decision to extubate a patient was pending, such as in the case below.

*He can breathe deeply, he has a reasonable cough and although the secretions are copious they come out easily. He has good air entry, a bit quiet on his bases, due to the infection he had, which seems to be improving, it was coming from purulent secretions to mucoid, his white cells have come down, he is afebrile, he had e.coli in his chest which has been treated for a few days now. He appears to be getting better, and he is just on CPAP of 5cmH2O with massive Tidal Volumes, starting to think that he is a candidate for extubation. [Interview with nurse Jane, Scotland]*

Both Scottish and Greek nurses had an increased role in providing chest physiotherapy when required. They also mobilised the patient frequently. Mobilisation involved mainly re-positioning of the patient from side to side every three to four hours. Scottish nurses were observed to mobilise the patients to a chair more often, in comparison to Greek nurses who did not have the means for this. Only one Greek nurse was observed to mobilise the patient at the edge of the bed.

#### 7.4.3 PSYCHOLOGICAL SUPPORT

Nurses advocated that the patient's psychological status influenced their weaning process. Reasons for a fluctuating psychological condition were the presence of agitation, and depression, and were more obvious with the patients who had a prolonged weaning time, such as patients 4, 6, 9 from the Scottish setting, and 11, 12, 17 and 18 from the Greek setting.



Part of maintaining a balance involved providing psychological support to the weaning patient. Nurses always informed the patient about the current health condition and the following intervention and ensured the patient was orientated on time and place. They also ensured the patient was comfortable and pain free. If the patient was in pain, they informed the doctor, who reviewed the sedation regime or prescribed painkillers. The Scottish nurse, below, illustrated the hypothesis she made regarding the patient's pain and the action she took in this matter.

*Just looking at pain, I looked back to the order of morphine, sometimes it's my impression that we underestimate the analgesia available, so having a look at the kardex he was written to titrate from 1 to 5mg of Morphine, so I just felt that I had a bit of room to increase...and I wanted to test that theory first to see whether I could make him more comfortable given the fact that he is a large chap and he might breathe more effectively and we might get further with weaning. [Interview with nurse Kate, Scotland]*

Nurses' input in assessing and managing the psychological needs of the patient during weaning was crucial. Nurses observed for signs of depression, manifested as lack of sleep during the night, alternating mood, lack of cooperation of the patient with the nurse and negative feelings expressed by the patients. They considered that those attributes influenced the patients' reaction to weaning from mechanical ventilation and included them in their assessment of the patients' ability to sustain further reduction of ventilatory support. Having a holistic view of the patients' condition, nurses stressed the importance of meeting the psychological needs of the patients during the weaning process.

## 7.5 CONCLUSION

This chapter described nurses' behaviour when weaning long-term ventilated patients. Both Scottish and Greek nurses conceptualised the patient's ability to wean taking into account a cluster of attributes and combined concepts to arrive at a decision about adjusting the ventilatory support. The theme '*wean as able*' illustrated the basic principle of weaning followed by both Scottish and Greek clinicians, which was depicted in the weaning pattern of each patient. It was obvious that the key decisions, such as initiation of weaning with reduction of sedation and change of the mode of ventilation, the trial of spontaneous breathing or extubation and tracheostomy formation were doctor-led. The '*wean as able*' instruction prompted nurses to adjust the ventilatory settings according to the patients' response. Nurses' involvement in making independent decisions in this part of the weaning process was limited and depended on aspects of the socio-cultural environment in intensive care. Greek nurses' involvement in the adjustment of ventilatory settings was more limited in comparison to their Scottish colleagues.

Analysis of the weaning patterns in each patient case demonstrated that the adjustments of the ventilatory support were diverse not only between patients, but also within the weaning strategy of the same patient. This diversity presumed the lack of sustainability in the reduction of ventilatory support and consequently the progress of weaning. It also affirmed a level of inconsistency in the decisions and approaches followed in each patient case.

Both Scottish and Greek nurses followed a conservative approach to weaning, which was translated into small and subtle changes of the ventilatory settings and depicted their attitude to optimize the patient before critical weaning decisions were made. Nurses ensured a balance between the sedation level and the effort of the patient to breathe, to the extent that it allowed the subsequent reduction of ventilatory support. The following chapter discusses the impact of socio-cultural factors of the decision-making environment that influenced nurses' clinical behaviour and resulted in the lack of consistency in decision-making during the weaning practice.

## CHAPTER EIGHT

# THE PRACTICE ENVIRONMENT AND ITS IMPACT ON DECISION-MAKING

## **CHAPTER EIGHT**

### **THE PRACTICE ENVIRONMENT AND ITS IMPACT ON DECISION-MAKING**

#### **8.0 INTRODUCTION**

The two previous chapters examined nurses' use of knowledge when making decisions about the weaning of long-term ventilated patients and how these decisions informed their daily clinical practice. Whilst both Scottish and Greek nurses demonstrated an exquisite cognitive ability to process and classify the available information from assessment of the patient in such a manner so as to reduce the cognitive strain of making a decision and respond to uncertain and complex weaning conditions, their role varied in making those decisions independently.

Examination of their clinical behaviour highlighted three main points. First, nurses followed diverse weaning approaches, which were an outcome of their interpretation of the medical instruction '*wean as able*'. Second, most nurses showed a conservative approach to reducing the ventilatory support in comparison to the medical staff who were more aggressive when manipulating the ventilatory settings. Third, key decisions relative to the initiation of weaning, the attempt of a spontaneous breathing trial (SBT) and extubation were a contested medical territory, whereas nurses seemed to get involved in the adjustment of ventilatory support, usually, after being prompted by the doctors.

Although one could argue that the diversity in the weaning approaches observed in the management of the selected patient cases, but also in the management of the same patient case, was a consequence of the clinical condition of the patient, the detailed analysis of the data suggested that the weaning approaches lacked sustainability and consistency. Observation of the decision-making environment revealed that socio-cultural factors influenced nurses' clinical behaviour and consequently had an impact on the weaning management of the patients.

This final chapter focuses on exploring these factors and their impact on clinical decision-making within the complexity of the critical care environment. Thematic analysis of fieldnotes and follow-up interviews with nurses, doctors and physiotherapists exposed three main themes; organisational structure; inter-professional relationships; documentation and use of weaning protocols. Commonalities and differences between the two practice environments and the clinicians' perceptions of teamwork and its effect on decision-making are also expressed.

## **8.1 ORGANISATIONAL STRUCTURE AND ITS IMPACT ON DECISION-MAKING**

Observation of both settings and interviews with the clinicians produced information on the organisational structure of the intensive care units. The shift pattern and team structure were important factors that affected nurses' input in discussions about weaning. Characteristics of the two settings are described in chapter four (section 4.1.4 and 4.1.5). This section analyses aspects of the daily routine in intensive care that influenced nurses' input in decision-making.

### **8.1.1 SHIFT STRUCTURE**

The structure of shifts was different between the two settings. In the Greek setting, 8-hour shifts were organised within 24 hours, from 7 am to 3 pm, from 3 pm to 11 pm and from 11 pm to 7 am the next morning. In the Scottish setting, there were 12-hour shifts, from 7.30 am to 7.30 pm, and from 7.30 pm to 7.30 am the next morning. It became obvious that the daily patient care was organised around the clock, and around the shift daily routine.

In the Greek setting, the morning ward round initiated at 8 am. It took place in the doctors' seminar room, where the medical director, the registrars, the junior doctors, and the nurse in charge on the shift participated and were informed about the patients' progress. Each doctor was allocated the care of three patients. Various decisions about the care of the patient, potential interventions and weaning plans were made at this stage. Decisions about weaning involved the initiation of the weaning process with the reduction of sedation or plans for extubation or tracheostomy formation. The doctor who was allocated the weaning patient was in charge of the weaning process. Decisions were not documented in the medical notes but were verbally communicated among the medical staff and the nurse in charge. Other decisions related to the capacity of beds, to potential discharges and new admissions.

A second ward round took place between 1 and 2 pm at each bed space. The medical team decided on changes of the provision of care, drug prescriptions or weaning plans. Decisions made included the interruption of weaning and increase of ventilatory support, continuation of weaning or alteration of the weaning approach or the management of sedation. The medical decisions were not documented but were verbally communicated to the nurse. However, doctors were frequently observed to intervene with the management of ventilation without notifying the nurse about the potential changes of the sedation level or the level of ventilatory support.

The nurse who looked after the patient had the possibility to be present during this second ward round. However, few nurses were observed to participate and have an input. Workload, lack of time and the fact that Greek nurses usually looked after more than one ventilated patient were reasons for not attending the ward round discussion.

In the Scottish setting, the morning handover was similar to the Greek setting. The morning handover included information about the patients' progress during the night shift. The difference between the two settings was that, in the Scottish ward, no major decisions were made at this stage. Instead, patients were allocated to the medical staff, who reviewed them between 9 am and 11 am, made a brief plan for the day, which was later discussed at the formal ward round. The ward round took place after 11 am and involved the medical team and usually the bedside nurse. Similar to the Greek setting, the nurse in charge did not participate in the ward round due to lack of time within her duties. Decisions made during the ward round involved interventions, drug prescriptions, and decision about weaning from mechanical ventilation. Most interventions occurred during the day, between 10 am and 3 pm. The doctors also reviewed the patients in the evening, before the change of the shift and made final decisions or alterations of the initial plan.

A characteristic aspect of the ward round structure was that medical staff were separated in two teams, which did not occur in the Greek setting. Each team was responsible for half of the patients in the ward; therefore, two simultaneous ward rounds took place with one consultant in charge of each team. The reason for this

organisational arrangement was the larger availability of beds of the Scottish ICU in comparison to the Greek ward.

The time of the ward round and how it was structured in each ward had an impact on nurses' input. Nurses in the Scottish and Greek setting reported that the time of the ward round did not always facilitate the collaborative decision-making between nurses and doctors about the patients' weaning plan. It was frequently observed that when the doctor assessed the patient in the morning or during the ward round, the nurse was having a break; therefore, the opportunity to exchange information was missed. Doctors in both settings advocated that the ward rounds were not interdisciplinary to involve the nurse and the physiotherapist in the exchange of information and in making collaborative decisions. Nevertheless, doctors acknowledged the importance of collaboration in constructing a weaning plan for the patient.

Another reason that explained the lack of nurses' participation at the ward round discussions, as pointed by both Scottish and Greek doctors, was that nurses were occupied with various tasks of patient care when the ward round took place. One of the nurses claimed that the ward round was an opportunity for her to leave the bed space in order to collect equipment, drugs, or materials that she needed. Consequently, she was not involved in the discussion with the medical staff, where uncertainties and suggestions could have been raised.

Nurses' daily routine was task orientated and organised according to the shift structure, and in particular break time allocation. Tasks, such as patient personal hygiene, bed bathing, drug administration, and physiotherapy had priority compared to the reduction of sedative drugs and the initiation of weaning. Scottish nurses, in particular, preferred to mobilise the patient to the chair first, and then start reducing the ventilatory support. A Greek nurse supported that nurses were occupied with patient care in the morning and were not willing to attend the ward round due to lack of time. In this excerpt, she described that in a busy morning, weaning was not a priority task.



*You do not have the time during a day shift, when one of your patients is going for a scan, the other one gets a tracheostomy, the other patient comes back from the scan. If everything is fine, we can start weaning. The result is that when you have a million things to do and the time is already 11 am, and you have not yet given your antibiotics, so as to keep the usual 8 hour antibiotic program, em, you do not work on the patient's weaning. Besides, in the morning there are in the unit 7 registrars and 10 consultants plus the junior doctors. You do not have the time, especially on Mondays or Fridays that you have to change all the giving sets etc. If you observe something, you will report it, but as soon as you do that and you see that the doctor takes over, you go and do something else.[Interview with nurse Vivian, Greece]*

Increased workload had an impact on the decisions to reduce the sedation and start weaning. One of the doctors in the Scottish setting explained that on a busy shift, a patient who wakes up needs constant observation and management, because there is a great possibility of becoming agitated and restless, risking a dislodgment of the endotracheal tube. For that reason, on a busy shift, nurses avoided reducing the sedation until they were prepared to provide full attention to the patient's weaning. This was particularly observed in the Greek setting, where nurses looked after more than one ventilated patient, but also in the Scottish setting despite the one nurse to one patient allocation. The Scottish nurse below explained the reason for delaying weaning.

*[...] I personally I don't like to wean my patient until they are washed, you know, they are sitting on a chair, until all the fuss of the morning ends, and then they are kind of ready to start weaning. But if there isn't anything else going on, if there are not too many distractions [...] So, quite often at that point, the doctors can come round and say 'come on, let's start weaning'. I say, 'yes, I am going to, I'm just going to get this done first'. And it is not that I am prioritising it lower than say getting washed, it is just if you are going to do it successfully, like in a long-term ventilated patient, it is going to be lots of work, then I expect I have everything clear so that I can concentrate on that. That's my way of doing it. [Interview with nurse Marion, Scotland]*

In summary, various aspects of the daily routine influenced nurses' input in ventilation weaning decisions. First, the time and structure of the ward round did not encourage nurses' involvement in the discussion about the patients' progress.

Second, nurses did not prioritise weaning in their task accomplishment for the day. Third, workload usually deprived nurses from having adequate time to be involved in team discussions about the patients' weaning management. Other elements of the organisational structure of intensive care related to the workforce and staff allocation system and affected the daily routine of nurses' practice and consequently their involvement in decision-making. These are explained in the following section.

#### 8.1.2 WORKFORCE AND STAFF ALLOCATION SYSTEM

Staff levels differed significantly between the two settings (section 4.1.5). In the Greek setting, the lack of nursing staff defined partially nurses' involvement in independent decisions about the ventilation weaning of the patients. For instance, on a day shift, when there was usually increased workload, doctors outnumbered nurses; therefore, they were available to observe and manage the weaning of mechanically ventilated patient. The fact that Greek nurses had to care for two or three patients on their shift, limited the time available to become involved in the discussions and decision-making about the patient's weaning.

In contrast, Scottish nurses cared exclusively for one patient during their 12-hour shift; therefore, they had the opportunity to be involved not only in the assessment but also in the discussion about the management of the weaning patient. An element that differentiated Scottish from Greek nurses' workforce was that in the Scottish setting permanent staff was divided in four teams, each of which had a team leader, and the members of the team usually followed the same shift rotation. This team structure was used to promote teamwork and effective collaboration and communication among staff. A second important element of the workforce was the possibility, in the Scottish setting, to cover lack of staff with agency or bank nurses.

An element related to the organisation of the shift that influenced nurses' input in decisions about the weaning of mechanically ventilated patients was the staff rotation and allocation system. The nurse in charge was responsible for arranging the staff rotation. In the Greek setting, nurses rotated more frequently compared to the

Scottish nurses, because they were working more days per week, although, in both wards, nurses worked for 37.5 hours according to the European Directives. Therefore, they had the possibility to familiarise with the same patient more rapidly and frequently. The charge nurse of the each shift was responsible for allocating the nursing staff. Observation of the daily routine in both settings revealed that nurses were not allocated the same patient when working on consecutive days. However, nurses perceived that caring for the same patient on consecutive days increased their knowledge of the patient's responses while weaning.

In the Scottish setting, the nurse in charge ensured that senior nurses with the adequate skills outnumbered junior nurses on the same shift. The allocation of nurses was based on the team they belonged to. However, observation revealed that nurses' turnout was not as frequent as in the Greek setting, resulting in fewer days caring for the same patient. Moreover, more junior nurses were observed to look after weaning patients rather than senior. This had an impact on assessing the patient's weaning capability and progress, and consequently making decisions on reducing the ventilatory support.

In both settings staff allocation and staff rotation systems influenced nurses' involvement in decision-making, because it deprived them from familiarising themselves with the patients and their responses to changes of the ventilatory support. Consequently, nurses had limited opportunities to know the patient and develop a constructive way of weaning. Greek nurses rotated more frequently, and so they had the opportunity to familiarise with the patient. Within the organisational structure of each setting, working relationships developed and influenced nurses' clinical behaviour and input in decision-making. This socio-cultural element is analysed in the next section.

## **8.2 INTER-PROFESSIONAL RELATIONSHIPS AND THEIR IMPACT ON DECISION-MAKING**

Analysis of the data suggested that relationships among members of staff were a dominant component of the practice environment. Participant observation, in both fields, exposed interactions between nurses and doctors, nurses and physiotherapists, and doctors and physiotherapists during the morning handover, the morning assessment of the patient, and the ward rounds. Interviews with members of staff gave insight into their perceptions of communication patterns and teamwork and the influence in decision-making.

In the Scottish setting, the bedside nurse had the opportunity to interact with the medical staff during the morning medical assessment and during the ward round or when the clinical condition of the patient required it. The physiotherapist interacted with the bedside nurse twice daily, when reviewing the patient. Nurses appeared to communicate and cooperate anytime throughout the day. In the Greek setting, nurses and medical staff interacted less frequently. For instance, bedside nurses were not observed to be involved in the discussion about the patient's progress neither at the morning nor at the afternoon formal ward rounds. Only the nurse in charge participated in the morning ward round and fed back to nurses the decisions made. Greek nurses interacted with the physiotherapist during assessment of the patient in the morning. Finally, nurses communicated and worked together throughout the day, similarly to their Scottish colleagues.

The reason for interaction among staff related to the provision of information about the patient's progress, to raising concerns when uncertain and to discussing a plan for action. Observation revealed that inter-professional relationships affected clinicians' communication and consequently collaboration when caring for the weaning patient, in both settings. Characteristic aspects of clinicians' interface are summarised in three sub-themes: Collaborative or antagonistic pairings; support in decision-making; and authority in decision-making. The following sections show how the working relationships among staff, the support nurses received from their peers and the

existing legal nursing framework influenced nurses' contribution in decision-making throughout the patients' weaning process.

#### 8.2.1 COLLABORATIVE AND ANTAGONISTIC PAIRINGS

Working relationships were a predominant factor that influenced communication and teamwork among clinicians. This perception was commonly expressed by medical and nursing staff in both settings. Scottish staff rated their teamwork as very good, whereas Greek staff rated it as average. However, they both stated that the quality of collaboration depended on specific '*pairings*' between nurses and doctors and between nurses.

Both Greek and Scottish nurses defined '*cooperative or collaborative pairings*' as harmonious, supportive and reciprocal dyads between nurses and doctors or between nurses that worked together to promote the patients' weaning. Trust, appreciation, respect and confidence were attributes that clinicians used to characterise these harmonious working relationships. An example of a reciprocal relationship was evident when doctors provided the instruction to wean the patient as able and expected that nurses would proceed with reducing the ventilatory support according to the patient's tolerance. One of the Scottish nurses pointed this out.

*They don't really say, they just say wean as able. So, it is kind of left to your own discretion. So, I think in this unit, it shows that the medical staff and the nursing staff have a good relationship like based on trust, you know. The doctors know that they can leave it to our discretion to wean as able, knowing that if there was a problem we could deal with it or we could approach them and have more input and more advice. We would approach the physios that we are able to make decisions based on the evidence that we have in front of us, and the patient's clinical picture. So, nurses are chief decision-makers, but obviously everything that we do is run by the doctors first. We don't just go mad and make it up.*  
[Interview with nurse Marion, Scotland]

The confidence between doctors and nurses, which characterised a harmonious relationship, derived from doctors' acknowledgement of the role of the nurse in

monitoring the patients' condition. Doctors were assured that nurses would provide them with the relevant information on the patients' progress, which nurses derived from assessment and which would lead to further ventilation management. This view was shared between Scottish and Greek doctors. The Greek doctor below demonstrated that.

*The role of the nurse is very important during the weaning. More, if she or he has the knowledge and the experience which is very easy to obtain in intensive care [...]. The nurse is by the patient for 8 hours continuously. The doctor will come in and out, he is responsible for all the patients, and he has referrals in other clinical areas, so he cannot be by the patient all the time. The nurse will appreciate sooner that the patient is able to continue with his weaning, because the doctor will only review the patient at the ward round. So I think nurses' role is very important. [Interview with doctor Zoe, Greece]*

However, cases of conflict between doctors and nurses were apparent in both settings, in which nurses behaved in a conciliatory and defensive manner. Disagreements occurred, mainly, when decisions about performing a trial of spontaneous breathing or extubating a patient were made. In such cases, nurses were in disbelief that their disagreement would be considered by the medical staff. This is illustrated by an experienced Scottish nurse when interviewed.

*Nurse: But again, sometimes, ultimately, when we (nurses) don't think that a patient is ready to wean, it is harder to say 'no, I don't think this patient should start', because that's when they are less willing to listen. If they think that someone has to start weaning, they want you to start weaning them. And that's when it becomes difficult to say I think we need to wait. Once you have started, they listen a lot more, but prior to that they pretty much say that's what I (the doctor) want.*

*CK: That's very interesting. Why do you think that is?*

*Nurse: I don't know if it is just because, like when you are in the process, they understand that you have been monitoring, you've watched them wean. Therefore, you base your decision on what you see happening; rather than before you instigate it, you base your decision on what you think will happen, and then it becomes a battle between what I think is going to happen as a nurse and what they think it is going to happen as a doctor. That's why we end up with... a conflict. You know! It's been there for a long time, I suspect it is going to be there for a long time as well,*

*but then it becomes more an interpersonal thing than an actual clinical decision. [Interview with nurse Lille, Scotland]*

The excerpt above demonstrated that in key decisions when the outcome was ambiguous, such as the patient's response to the reduction of sedation and the institution of spontaneous breathing, nurses' input had little effect in influencing a predominantly medical decision. It was acknowledged that conflicting ideas about the weaning practice did not facilitate shared decision-making that would result in a construction and documentation of a coherent weaning plan, as one of the Scottish nurses pointed out.

*Weaning is such a personal thing, and a lot of it is a psychological as well as physical thing, and I think because of that...and because we have conflicts, nobody comes out and says 'well my way is the correct way'. Therefore, we don't end up with an absolute plan, and then, everybody comes in and changes how the things are meant to go in 24 hours, which is not good for the patient. [Interview with nurse Lille, Scotland]*

An example illustrating conflicting ideas about the patient's ability to sustain a trial of spontaneous breathing was patient 9 of the Scottish sample. While the patient required high concentration of oxygen supply from the ventilator (FiO<sub>2</sub> was 0.8), one of the consultants decided to change the ventilatory support from Pressure Support Ventilation (PSV), with PS of 10cmH<sub>2</sub>O and PEEP of 10cmH<sub>2</sub>O, to CPAP of 8cmH<sub>2</sub>O. The nurse disagreed with this intervention. The patient tolerated this change for 10 minutes before his work of breathing increased and became hypoxic. The nurse observed an increased respiratory rate, low SpO<sub>2</sub>, increased heart rate and informed the doctor about the patient's response to the change. The doctor, then, decided to increase the ventilatory support. Despite nurses' disagreement with the particular decision, the doctor proceeded to its accomplishment. Similar examples were apparent in both samples. Such examples implied a lack of shared decision-making in key decisions of weaning and engaged the perception of authority in decision-making that is thoroughly discussed in section 8.2.3.

The concept of ‘*pairings*’ was apparent in nurses’ interpersonal relationships and influenced their behaviour when caring for a weaning patient. Greek nurses regarded their inter-professional relationships as more competitive than those with the medical staff, which resulted in lack of collegiality. The excerpt from an interview with an experienced Greek nurse, below, portrayed nurses’ working relationships, and highlighted that their collaboration depended on the nature of the task that needed to be accomplished and on nurses’ enthusiasm to work together to tackle the problem. Nurses that were more excited with their job tended to collaborate more in tasks such as mobilising the weaning patients and providing physiotherapy, which were crucial interventions during the weaning process.

*CK: So, we talked about nurses’ cooperation in this unit. In what level do you think it exists?*

*Nurse: It depends on the nurses who are on shift. Everywhere you find good and bad relationships. Ok. If there are people who like each other on the shift, team work is excellent. If you work with a colleague who is also enthusiastic, you will turn your patients more frequently, you will provide personal hygiene when they need it, if something of emergency happens regarding his breathing, you will not call the doctor immediately. Both of you will work together first; two minds are better than one. You will say your opinion, you will use the breathing bag, you will suction the patient, and you will do some physiotherapy. On the other hand, if you are alone and at that time there are other people that you don’t get along with...well I do not have these problems, I work well with everyone, but it is something that I have noticed. Generally though, ok, teamwork as far as the patient’s benefit is concerned, it exists. If an emergency happens everyone will run. But if not, there is no team work. [Interview with nurse Tony, Greece]*

One of the Greek nurses, in her interview, highlighted that assertive and opposing behaviour by her colleagues reduced her enthusiasm and de-motivated her from using her skills and knowledge to benefit the patient.

*Nurse: You know that sometimes you view things differently than other people do. I am very embarrassed to work here as I have learnt to work at the university, how I studied to work. I am very embarrassed.*

*CK: Why?*

*Nurse: It’s... You have to decide whether you want to do your job as you have been taught to do it, or, if you want to have a good relationship with*



*your colleagues and go out for a coffee with them. It depends on the people you are on the shift. If I am with more relaxed people, I don't mind. If I am with people who cause problems, I don't even use the stethoscope to assess the patient's chest. However, on a night shift that is dark, when everything looks fine, I also assess the abdominal sounds, I will assess my patient better, clinically, I mean. During the day shift, I do it very rarely. Unless there is something urgent and the doctor cannot come immediately, I will use the stethoscope to listen to the patient's chest and I will call him to say that the patient does not ventilate from the right side, he is tachypnoec, etc. [Interview with nurse Irene, Greece]*

In contrast, Scottish nurses claimed that there was an excellent collaboration among nurses, especially between junior and experienced, and in between physiotherapists and nurses. Indeed, personal preferences that were a characteristic element of the Greek nurses' working relationships were not observed in the Scottish setting. In contrast, a trusting personal relationship increased communication between clinicians and facilitated nurses' contribution in decision-making.

Participants in both settings highlighted the impact of personality in forming collaborative working relationships. From nurses' point of view, 'pairings' depended on the personality of the doctor that was in charge of the patient's care, and mainly the consultant. In both settings, nurses viewed the doctors as more approachable when they considered nurses' judgment of the patient's ability to wean. Observation revealed that the majority of Scottish doctors encouraged and challenged nurses to participate in the discussion about the patient's weaning during the ward round, if present. They asked for their opinion on various aspects of care, such as the quality of secretions, the cardiovascular stability of the patient, the ability of the patient to cough, and the tolerance of spontaneous breathing, information that derived from patient monitoring. In the Greek setting, limited interaction took place between the bedside nurse and the consultants at the ward round, whereas nurses described registrars and junior doctors as more accessible and interactive when dealing with uncertain situations.

One of the junior nurses, in the Scottish setting, expressed a similar view about doctors' willingness to involve nurses in decision-making, particularly junior.

According to Scottish nurses, a doctor who encouraged and prompted nurses, even junior, to express their opinion about the patient's weaning was considered open and accessible. This was consistent in both settings.

*Certainly communication issues, some members of staff may be unapproachable, but if they are, there is someone else who can help me out, anyway. It all has to do with the personalities. Maybe the doctor and nurse communication could be a bit better, because sometimes at the ward round, they (the doctors) might be talking to themselves and you try to pick up what you can. You certainly ask questions, but when it comes to making decisions, they kind of make them between themselves and they don't really speak up and make it clear what they want me to do.*  
[Interview with nurse Paul, Scotland]

Greek and Scottish doctors, on the other hand, underlined that nurses' involvement in weaning depended not only on their expertise, but also on their personality and motivation. One of the Greek doctors divided nurses into three categories and explained the reason for this distinction, as demonstrated in the excerpt below.

*Doctor: There are nurses who can wean, there are nurses who cannot wean and there are nurses who do not want to intervene with weaning. It depends on the person.*

*CK: What is the reason for that?*

*Doctor: It depends on their willingness. Most of the nurses we have here are very clever; we do not have stupid people here. And because they have many years of experience they can do it (weaning), most of them. They all can do it. Some of them are not interested, some of them are, it depends how motivated they are and willing. Most of the nurses do not have a motive. They cannot be bothered to do their job. That is the worse. Those nurses who are motivated, they like their job, and they view the patient as their patient not only the doctor's patient. Some of them are excellent.* [Interview with doctor Chris, Greece]

A Scottish consultant, in agreement with the Greek doctor, pointed that intensive care offers a secure working environment for indecisive and reluctant nurses, because of the continuous presence of doctors who take responsibility of the decisions made.

*There are some people who will take initiative and some people won't. I think some people need to be pushed to make decisions. It is a personality issue as well, that's right. It is not just the unit. Certain people, if you are the sort of person that can't make decisions, ICU is maybe an easy place to end up. If you end up in an acute medical ward, being a nurse for many years and you can't make decisions, then the whole place is starting to fall about your ears; but here in ICU, you can do the minimum as an intensive care nurse. I'm not saying....that's the reason why a lot of nurses refrain. There is the ability to do the minimum, just to fill in your chart and write your notes and that's it. [Interview with doctor Alan, Scotland]*

The excerpts above demonstrated a contradiction in the way nurses and doctors viewed nurses' participation in decision-making. Nurses felt that they were not encouraged enough by the medical staff to be involved in the discussion about the patient's weaning plan and progress. On the other hand, doctors, in both settings, highlighted that nurses were reluctant to engage into decision-making, regardless of the level of experience and take responsibility for their decisions. Various reasons that explain this behaviour related to the level of support and leadership that fostered nurses as autonomous decision-makers and are analysed in the next two sections.

#### 8.2.2 SUPPORT IN DECISION-MAKING

The concept of support in decision-making was directly intertwined with the inter-professional relationships, and in particular the 'pairings' among nurses and between nurses and doctors. Nurses, when interviewed, expressed their views about the level of support they received from their peers and the medical staff when caring for weaning patients. Greek nurses agreed that they received a limited level of support by senior nurses. For example, one of the junior nurses felt de-motivated when first employed in intensive care, despite her enthusiasm of starting her nursing career. She faced a very competitive working environment, with limited educational support and guidance from senior nurses. Tension in the inter-professional relationships due to increased workload and stress increased this negative and discouraged feeling. A

senior nurse advocated that the lack of collegiality among nurses was due to the lack of time and momentum.

Another Greek nurse with 11 years of experience highlighted that nurses, either junior or senior, have not been '*looked after*' by their leaders. She gave an example of her personal experience, when she requested to be transferred to a different ward, because of burn out after working eleven years in critical care. Her query was refused by the Nurse Manager without discussion, suggesting a lack of support at a managerial level. The nurse expressed her disappointment stating that there are inequalities in how nurses were treated not only between senior and junior nurses but also among senior nurses. Personal preferences, as mentioned earlier, favoured some nurses compared to others, as pointed in the excerpt below.

*Nurse: What I see here is an inequality, when someone wants to learn, not only do they not help him but they object as well.*

*CK: But why that happens?*

*Nurse: I will tell you why. It starts from the manager and the nursing director. They, themselves feel deficient in knowledge. When they introduced the postgraduate programs, they had to decide who was going to enrol, but most of them did not even have the proper qualifications to apply. And, when you see a 20-25 year old junior nurse willing to learn, you can't put up with it. Many times they have rejected people's applications for study leaves, they don't give them the opportunities...and those nurses have to suffer. There is no progress on that field at all. Even for a seminar, or a conference, there are people who had to take their annual leave to go. Or, they tell you that you can't go. We were 4 nurses, who went to a conference, and 2 had study leave and the other 2 had to use their own annual leave to go. Because the manager said that 4 nurses to go to a conference are too many to be away from the unit. [Interview with nurse Maria, Greece]*

One of the Greek nurses faced a disrespectful and negative attitude from her colleagues, after she finished her postgraduate studies. The nurse explained that many senior nurses have outdated ideas in some aspects of patient care, including weaning, and they were resentful of evidence-based ideas from highly educated nurses. In such an unfriendly and competitive environment, nurses avoided taking initiatives and being involved in decision-making.

The lack of formal training on mechanical ventilation and weaning was also considered as lack of support to make informed and autonomous decisions. Characteristically, when the weaning protocol was introduced, nurses were neither informed about its existence nor involved in its implementation. All in all, Greek nurses appeared to be deprived from continuous professional development, leadership and encouragement from their managers, which reduced their confidence and professional credibility, and therefore, their input in decision-making (more examples are presented in Appendix 7.3). As a consequence, nurses' avoided being involved in decisions; an attitude received as lack of interest about patient care, crafting a vicious circle.

On the other hand, Scottish nurses expressed that the support they received from senior nurses was satisfying, but highlighted that it did not lead to a culture of autonomous decision-making. Nurses and doctors agreed that workload and skill mix were the main reasons for developing a constructive dialogue between junior and senior nurses about the patients' weaning management. As a consequence, nurses felt reluctant to make decisions on the adjustment of the ventilatory support independently; in particular when the outcome of the decision was uncertain, resulting in delays of the patient's weaning process. All Scottish nurses stressed that there is need for support of junior members of staff when managing the ventilator and patient's weaning process. One of the nurses remarked that the medical instruction '*wean as able*' left nurses, in particular junior, with a vague plan about weaning and weaning progress to nurses' personal discretion. Inadequate mentorship of junior nurses undermined their involvement in decisions of adjusting the ventilatory support, particularly changes of PS, PEEP and SBT (see Appendix 7.3).

In summary, Scottish nurses were more supported in being involved in the weaning process by their peers than their Greek counterparts, but this support did not encourage an independent role in decision-making about a preconceived medical territory, such as mechanical ventilation and weaning. The perception of authority and legality in decision-making could explain the lack of a culture that would support nurses' independent decision-making in weaning practices.

### 8.2.3 AUTHORITY IN DECISION-MAKING

The theme of authority in making decisions included the concepts of legality and accountability in decision-making and was interrelated to nurses' conceived role in weaning practice. A common consideration between Scottish and Greek nurses was that they did not have a legal cover by their professional body to make decisions about weaning. Nurses agreed, unanimously, that the decisions of initiating the weaning process, performing a trial of spontaneous breathing and manipulating the ventilatory settings were not part of their duties, but rather a medical action; therefore, they conceived adjusting the ventilatory settings an illegal act. A convenient informal agreement with the doctor, however, gave nurses some authority to make decisions about adjusting the ventilatory setting and provided them with a legal cover. The key decisions about extubation and initiating weaning still remained medically-led.

*And if the doctors are comfortable with the nurses, then we can make decisions ourselves as opposed to asking them every time we want to do something. Which we do, because we feel like that we should! Because it is the doctor's decision at the end of the day. If anything goes wrong, then, I think we just need to be able to say, well I did inform the doctor that I'm going to do that, and they are happy for us to do that. I think nurses always feel that they have to have an approval from the doctors to do things. Just as to have a back up to say that I felt the patient was ready for this, but I just wanted to double check that you are happy for me to do this. [Interview with nurse Eric, Scotland]*

Another nurse added to this.

*CK: I have heard that you cannot intervene because you are not covered legally.*

*Nurse: Yes. Based on the legislation we can only put a venflon and be legally covered for that. The law does not cover us in most of our interventions. But, the legal part is different with what we can do and what we actually do. Based on the law we are not allowed to wean, and we are not allowed to do many other things. But we do, and that depends on the nurse if she wants to intervene. I think that if you see a patient who is distressed, has 190 systolic blood pressure, breathes with difficulty and has 50 breaths per minute, I think it's wiser to re-connect him to the*

*ventilator and re-sedate him and then you can inform the doctor.*  
*[Interview with nurse Sophia, Greece]*

The above excerpts demonstrated that an informal convenient agreement with the medical staff provided nurses with authority to make weaning decisions, but also highlighted that they delegated the responsibility of the decision to the doctors, because they did not consider it part of their role. Doctors in both settings underlined that nurses' involvement depended on their willingness to take responsibility and become accountable for their decisions, and expressed their disagreement with nurses' view about the legal cover in decision-making.

In summary, this section gave insight into the inter-professional relationships between nurses and doctors and their impact on constructing nurses' decision-making territory. Collaborative relationships were characterised by trust and confidence in nurses' skills and knowledge to make decisions about the patients' weaning process. Indeed, in the Scottish setting, nurses were observed to instigate and coordinate the weaning process as part of their daily routine more often than their Greek colleagues, as illustrated in chapter seven. However, nurses did not conceive weaning as part of their role and were reluctant to be accountable for such decisions. This behaviour was observed in both settings and raised concerns about the managerial support and leadership of critical care nurses in their daily routine and its role in establishing a culture of practice that would encourage and promote a shared responsibility in clinical decision-making. Clearly, the legal framework for nursing practice and its interpretation in each setting acted unconstructively in nurses' involvement in weaning decisions. Within this mindset, the structures of documentation and clinical protocols played a significant role in providing legal support in decision-making. These elements are discussed in the following section.

### 8.3 THE USE OF WEANING PROTOCOLS AND DOCUMENTATION OF WEANING PLANS

Analysis of the data highlighted the role of the weaning protocols and the role of a formal documentation scheme for weaning plans to support clinical decision-making. In both settings, there was an implemented weaning protocol in the form of an algorithm. Greek clinicians have implemented the Ely, et al. (1996) weaning protocol, which included an early sedation hold and trial of spontaneous breathing. In the Scottish setting, the Ely, et al. (1996) weaning algorithm was adjusted and a list of weaning criteria was available to instigate weaning initiation.

Participants in both settings advocated that the weaning protocol had a manifold role. For both Greek and Scottish nurses it was used as a guideline to their decisions. Its role was to support and direct junior nurses in their decisions about reducing the ventilatory support based on particular clinical criteria. More experienced nurses felt that they did not need to follow the protocol by letter because they could use their clinical judgment and experience when deciding on the reductions of ventilatory support. However, they felt secure in having a guideline to which they could refer to when uncertain. One of the Scottish nurses pointed this out in his reflective interview when he talked about maintaining the patient on low support (CPAP of 5cmH2O) overnight and extubating him the following day.

*Nurse H: So, I don't know, I just decided to refer to what the doctors said. Probably if there was a protocol and I had ticked all the boxes, I would say, look I have ticked all the boxes why don't we extubate him. But we don't have that.*

*CK: So, you feel that you need something to prove your decision?*

*Nurse H: Well, certainly with the way it was the protocol before it was more entitled to work in conjunction with the medical staff, you know. If the patient did meet all the criteria, then you know, they could sign and say yes does he really need it...so if you have a protocol you go along with that and they don't have to ... you know it builds your confidence as well, and the doctors they don't feel that they are dictated by the nurses, because it is the protocol that has been decided by all of us. [Nurse H, Patient 10, Scotland]*



A second role of the weaning protocol, as supported by clinicians in both settings, was that it could standardise the care of weaning patients, because it could provide sustainability in the reduction of ventilatory support. In chapter seven, however, it was illustrated that the weaning approaches followed in each patient case were characterised by lack of sustainability in the reduction of the ventilatory support, periods of prolonged weaning inactivity and abrupt changes of ventilatory support used interchangeably with more gradual reductions.

These approaches contrasted the continuing reduction of ventilatory support that the weaning protocol suggested and demonstrated that the weaning protocol was not followed. Participants highlighted two main reasons for the lack of sustainability. First, that the weaning protocol was not applicable to the particular weaning cases. Indeed, it was advocated that long-term ventilated patients required an individualised approach to weaning, which could not be supported by a single algorithm. One of the senior nurses commented on the applicability of the existing weaning protocol, highlighting that it was very aggressive for the long-term ventilated patients. Consequently, the weaning of these patients relied on consultants' preferences and approaches. He characterised the existing practice of weaning as '*yo-yoing of pressure support*' to signify the lack of consistency in the reduction of ventilatory support.

The second reason that explained the lack of applicability of the weaning protocols was the fact that weaning decisions were based on the discretion of the medical team. One of the Greek nurses highlighted this in the excerpt below.

*CK: What I want to ask is how do you make the decisions for weaning of long-term ventilated patients? Are they based on the protocol?*

*Nurse: First of all, this is not a nursing decision, the doctor decides about that with our contribution, of course. This is a decision that is made by the consultant who is responsible for the patient, and is followed by the registrar, the junior doctor, the nurse and until recently by our physiotherapist, who used to have a pivotal role when she was here permanently. I mean it is not our decision to make, em..., the protocol, if it is going to be followed or not is up to the doctor who will decide whether we will proceed with the usual steps or he will follow something*

*else. This is not usually a decision for the nurses to make. [Interview with nurse Georgia, Greece]*

However, one of the doctors expressed a very interesting view on the functionality of weaning protocols. He advocated that weaning protocols are essential for teams that do not have expertise in respiratory physiology and mechanical ventilation, and, therefore, can guide their decisions during weaning. However, in his argument, he referred to the use of protocols by medical teams but excluded nursing staff, experienced or inexperienced from becoming more involved in the decision-making with the help of the protocol.

*Some studies support that the protocol is effective for the units that do not have experience in weaning. We do follow a protocol but not by the book. And we do not, because protocols are for those who do not know how to wean, no matter how bizarre this sounds. Those who do not know what to do, use the protocols, in order to have a guideline, because it is better to have a guideline than not knowing what to do. Studies have proved that ICU teams, who are experienced in managing the respiratory system and they know how it works, do not need to follow a protocol. It is better to have a very experienced doctor who knows what the patient needs. [...] If you know the respiratory system very well, you use your experience and you finally end up using a protocol but in a more flexible way, you can make adjustments without having a protocol, an algorithm to tell you do this if that, or do this if that. There is no reason to do that. If you have noticed here, all doctors wean with the same way, because we are a homogenous team, we have studied the same process, the professor has taught us in the same way, so our decisions are homogenous. For example, Maria will start weaning, I will take over from her on my shift, and we will follow the same approach because we have the same education. [Interview with doctor Chris, Greece]*

The third role of the weaning protocol according to nurses' perceptions was that it provided a legal cover to base their decisions on. However, the lack of applicability of the weaning protocol for the long-term ventilated patients derived nurses from having a legal cover to make independent decisions. Clearly, nurses in both settings appreciated the existence of a formal documentation method which could increase their authority in decision-making.

In the Greek setting, there was no formal documentation of medical instructions. Doctors communicated weaning decisions verbally, which the nurse had to carry out and inform about the outcome. This lack of documentation, either in the form of a weaning protocol or a documented weaning plan, deprived nurses from having a legal cover to support their decisions and be considered accountable for their clinical behaviour. Consequently, they avoided to be involved in clinical decision-making and adopted a defensive behaviour.

In contrast, in the Scottish setting, weaning decisions were documented in medical notes on a yellow sticker attached in the notes. Doctors documented any decisions about the patient's ventilation and weaning in a codified form, such as '*wean as able*', '*ready for weaning*', or '*reduce sedation*' or as threshold levels for respiratory parameters, such as '*PaO<sub>2</sub>>9kPa*', or '*PaCO<sub>2</sub><8kPa*'. This provided a sense of support and increased nurses' confidence to make decisions about reducing the sedation level or the level of ventilatory support. However, the instruction to '*wean as able*' or wean to maintain adequate gas exchange did not provide any specific approach in reducing the ventilatory support. The interpretation of the medical instruction was based on nurses' clinical judgment and depended on their level of expertise and confidence, as explained earlier, and not on the existing weaning protocol.

In summary, it became apparent that the existing weaning protocols were not applicable for the long-term ventilated patients; therefore weaning decisions were based mainly on nurses' and doctors' clinical judgment. Patients were managed differently according to their needs and according to the clinicians' preferred weaning approaches. The lack of a formally constructed weaning plan did not facilitate the involvement of each member of the multidisciplinary team in the implementation of weaning, and it did not provide support and guidance for the more junior nursing staff. This resulted in a lack of consistency in the reduction of ventilatory support, which was manifested with the various and irregular weaning patterns observed in each patient case, as illustrated in chapter seven.

## 8.4 CONCLUSION

This chapter touched a variety of elements that pictured the culture of each intensive care unit and its influence on weaning decision-making. The socio-cultural factors examined involved the inter-professional relationships and communication among clinicians, the working environment and its impact on nurses' role in decision-making, as well as organisational features of the daily routine.

There was an agreed decision-making territory in the key decisions of weaning, such as initiating weaning, extubating or attempting a trial of spontaneous breathing or of subtle adjustments of ventilatory settings or tracheostomy formation. These decisions were predominantly medically-led. Nurses were not encouraged to do more than small and incremental changes of the ventilatory settings under the unspecified medical instruction '*wean as able*', which led some of them to become passive and reluctant to go beyond that. Although in the Scottish setting, nurses appeared to be more active in those subtle changes of ventilatory support, in both settings, the culture of the critical care environment did not foster nurses' autonomous decision-making in the medically dominated field of mechanical ventilation and weaning.

Doctors appreciated nurses' input in information provision about the patient's progress, but nurses' further involvement in instigating weaning or participating in shared decision-making depended on the quality of inter-professional relationships within the existing culture of the decision-making environment. Increased workload and lack of support from senior staff resulted in de-motivation and reluctance to participate in weaning decision-making. Most nurses in the Greek setting felt burnt out considering the amount of work, the stressful, demanding and many times competitive environment. Lack of opportunities for further professional development and inequalities, personal preferences and power distribution resulted in a lack of morale and momentum to become more active and autonomous decision-makers. In contrast, Scottish nurses felt more supported by their peers during their daily routine, but this support did not always provide an environment for independent nursing decision-making.

Documentation of clinical decisions either in the form of a weaning plan or in the form of a protocol offered a legal cover for nurses to base their decisions on. Nurses did not feel accountable for making decisions about the weaning process, since they considered it a medical duty; therefore, the documented medical instructions gave them authority to proceed with the small, subtle changes of ventilatory support.

The findings of this study demonstrated that nurses used their clinical judgment to rationalise their clinical behaviour, but their behaviour was restricted and influenced by socio-cultural factors of the critical care environment that deprived them from becoming independent decision-makers. Many issues for discussion arose, which will be addressed in the next chapter.

# CHAPTER NINE

## DISCUSSION

## **CHAPTER NINE**

### **DISCUSSION**

#### **9.0 INTRODUCTION**

This ethnographic study explored how nurses processed complex information from assessment of long-term mechanically ventilated patients and used their knowledge to make decisions about discontinuing the ventilatory support and reinstituting spontaneous breathing. The study also focused on the interpretation of those decisions into clinical practice at the bedside and explored the socio-cultural factors of the practice environment that had an impact on nurses' decision-making behaviour.

Since my dual role of a nurse-clinician and nurse-researcher, undoubtedly, influenced the collection and management of the data, the use of auto-ethnography proved valuable, as a method to question my insider and outsider nature prior to entering the main field for data collection. This chapter starts with arguing about the use of auto-ethnography as a research method to reduce the inevitable bias when conducting research in one's own field and proposes its use in future ethnographic research in nursing.

Discussion then follows on the decision-making processes that thirteen critical care nurses in the Scottish and Greek intensive care units (ICU) used to manage the weaning of long-term mechanically ventilated patients. Nurses acquired and retained attributes and concepts relative to the respiratory function of the weaning patient, generated hypotheses and validated them in order to inform their decisions and clinical behaviour. These decision-making strategies are discussed along with possible cognitive biases and heuristics that characterised nurses' clinical judgment and decision-making. It is believed that by studying nurses' clinical judgment in the real setting, we can identify ways to advance their decision-making techniques and improve their clinical practice on mechanical ventilation and weaning.

The weaning approaches, as illustrated in chapter seven, pictured nurses' clinical behaviour. These approaches are discussed in relation to the existing literature on weaning from mechanical ventilation questioning the role of weaning protocols in facilitating decision-making. The focus is on identifying approaches that can facilitate the weaning of long-term ventilated patients.

The chapter continues with discussing the socio-cultural factors that related to the practice environment and influenced nurses' decision-making behaviour summarising the main differences between the two settings. The focal point of the dialogue is on the necessity to involve the elements of the practice environment when studying clinical decision-making. These elements should be considered when quality improvement interventions are planned to foster a shared decision-making culture in critical care relative to mechanical ventilation and weaning management for long-term ventilated patients.

Reflection on the methodological issues including the limitations of conducting this study is outlined. The chapter concludes with recommendations for clinical practice, education and further research in the field of weaning decision-making.



## 9.1 THE USE OF AUTO-ETHNOGRAPHY IN NURSING RESEARCH

Anthropologists and sociologists advocated the use of self in conducting ethnographic research and supported the use of auto-ethnography in increasing self-awareness (Stoller, 1989; Okley and Callaway, 1992). However, nursing research literature is concerned with the strategies designed to assist nurse ethnographers to manage the self in order not to contaminate the data (Polit and Hungler, 1999).

Several recent nursing studies argued that the observers should strive to be unobtrusive and avoid bringing their feelings, experiences, and assumptions of meaning to the study so that the data do not become biased (Graneheim, et al., 2001; Scanlan, et al., 2002; Mishoe, 2003). In my opinion, the impact of the '*self*' when conducting research in your own field is almost inevitable, but when acknowledged it can be avoided.

Auto-ethnography facilitated the recognition of my dual role of a nurse-clinician and a nurse-researcher and helped me identify my preconceptions and personal positions of the topic under study, so as to distinguish them from those of the participants. Auto-ethnography was used as a method of reflection on my own beliefs, on my own practice and my own perceptions of nurses' decision-making behaviour when managing long-term ventilated patients. It encouraged me to think about my personal past and current clinical practice in intensive care, and how it has evolved and changed throughout the seven years of clinical experience.

The reflective account of my personal practice became data available to interpretation. I engaged into the data and tried to provide a meaning based on my beliefs about nurses' role within the multidisciplinary team and nurses' autonomy and ability in making clinical decisions relative to the weaning management of long-term ventilated patients. Coming from the personal position that critical care nurses should have an autonomous role in decision-making about weaning and be able to manipulate the ventilatory settings to achieve liberation of the patient from mechanical ventilation, I viewed myself as an independent and responsible professional. Reading through the transcript from verbalisation of my thoughts, I

realised that my knowledge and experience could support autonomous decision-making. This presumption could easily influence the interpretation of participants' behaviour by imposing my reality as an autonomous critical care nurse to the reality of the participants. Having recognised this bias through auto-ethnography I was able to question nurses' clinical behaviour and noted any relevant comments on the reflective diary.

A second insight acknowledged through the auto-ethnographic exercise was related to the type of data I wanted to focus on. Nurses' job is a lot of times task orientated; therefore, many decisions aim just to accomplish a task, such as collecting blood samples. The challenge when interpreting nurses' role in decision-making would be to differentiate between the task autonomy and decision autonomy in daily practice. Auto-ethnography helped me familiarise with the type of data that would provide a rich view of clinical decisions, so as to make inferences on nurses' role in decision-making. The acknowledgement of the importance to distinguish task accomplishment to clinical decisions led to the construction of the Decision Episodes Tool (DET), which allowed the examination of ventilation weaning decisions.

Analysis of the think aloud transcript from the auto-ethnographic exercise revealed the value of my embodied knowledge and how it became explicit when verbalised. This knowledge was well hidden in my memory and informed many of my decisions. However, it became clear that when knowledge is verbalised it changes from implicit to explicit, which created a challenge in identifying nurses' implicit knowledge and try to interpret it. The risk was to impose my understanding of nurses' behaviour instead of theirs. To avoid this risk, I used my nurse-researcher role and asked the '*daft*' question, with the view to challenge the nurses to talk about their understanding of the decision made.

Another assumption was that the verbal protocol would assist in accessing nurses' mind, but practicalities needed to be resolved before entering the main data collection field. That was addressed with conducting a pilot study to assess the feasibility of using think aloud as the main data collection method.

Another preconceived assumption related to decision-making was my belief that Scottish nurses would behave more independently in their clinical decisions compared to their Greek colleagues. This inference was rooted to the existing biomedical model of care that characterises the Greek clinical environment and deprives of or discourages nurses from having an advanced role in mechanical ventilation management. This belief was confirmed by my own experience of working in a Scottish clinical environment, where nurses have a more collegial and advanced role and are not considered just the '*eyes and ears*' of medical staff. I acknowledged that this postulation would mislead the interpretation of data in favour of the Scottish sample jeopardising the presentation of truth.

Observing my own clinical practice and commenting on my clinical decisions about weaning, I started interrogating about the identification of weaning as a concept. For me, weaning meant the reduction of ventilatory support in order to institute spontaneous breathing and liberation of the patient from the ventilator. It meant reduction of the pressure support (PS) level, of the Positive End Expiratory Pressure (PEEP) level, a trial of spontaneous breathing, a change of mode from a mandatory model to an assisted spontaneous model. Auto-ethnography helped me realise that participants would not share the same definition of weaning with me; for some nurses weaning might have meant just the reduction of the oxygen level. The definition that nurses gave to weaning might have influenced their perceptions on the weaning decisions and their input in decision-making. In agreement with the literature on weaning and mechanical ventilation, I decided to consider weaning decisions those that related to the adjustment of the positive pressure support (level of PS and PEEP) and the mode of ventilation, without ignoring the change of the oxygen level.

In order to avoid relinquishing my views and understandings, but also to be able to grasp the full significance of participants' views and distinguish them from my own, I carefully attended the data collection techniques and used triangulation to capture the different angles of the topic and give all participants equal voice. Using a

reflective diary to report on my reflections while collecting and analysing data facilitated this purpose.

In summary, the auto-ethnographic exercise allowed me to foresee and make explicit my assumptions about nurses' knowledge of weaning and use them judiciously to give meaning and focus to the study. It helped me identify my perspective as a critical care nurse and as a researcher and anticipate how that may have affected what I reported. Moreover, the reflective diary was used as a tool to report and distinguish my own feelings and pre-assumptions so as to give justice to the data. Certainly, the uncertainty about the interpretation of data remains, as this study was limited to a specific sample of nurses, but more focused studies on clinical decision-making during the weaning process could increase the validity of the findings. It is suggested that auto-ethnography can be used to offer a robust approach to meet the aims of an ethnographic study.

The following sections will discuss the findings of the main study, starting with the characteristics of nurses' cognitive process when making decisions about the patients' weaning process.

## **9.2 UNDERSTANDING NURSES' DECISION-MAKING WHEN WEANING MECHANICALLY VENTILATED PATIENTS**

The concept attainment theory offered an approach to understand and analyse critical care nurses' thinking and decision-making when caring for long-term ventilated patients and the complex process of their liberation from mechanical ventilation. It offered an approach to conceptualise how information is organised and processed in human mind (Norman, et al., 1985; Grant and Marsden, 1988; Parrino and Mitchell, 1989). It is based on the general intellectual human capability of categorising a set of objects based on the attributes that define them, so as to diminish the mental energy and conserve time when making decisions (Bruner, Goodnow and Austin, 1956). In this study, this theory was used to comprehend the concepts that nurses attained when assessing and managing the complex task of weaning from mechanical ventilation, so as to reduce the intricacy of the task, to reduce the necessity of constant searching of weaning criteria, to identify particular events of weaning and link them to their particular management and, finally, to order and relate classes of events and give them a meaning (Bruner, Goodnow and Austin, 1956).

This section will discuss the general characteristics of nurses' decision-making when assessing and managing a weaning patient and will link the attributes and concepts that they used in their weaning decisions with the weaning criteria supported in the literature. Discourse continues on the generation and validation of the hypotheses made, and the decision-making strategies that critical care nurses used to make a choice and apply them in practice under certain and uncertain clinical situations. Biases and heuristics of clinical decision-making will also be discussed to provide a holistic view of nurses' decision-making processes.

### **9.2.1 GENERAL CHARACTERISTICS OF NURSES' DECISION-MAKING**

Critical care nurses in both settings were observed while assessing and managing long-term ventilated patients. Specifically, thirteen Scottish and Greek nurses with a range of experience participated in reflective interviews at the end of their shift,

while they looked after a long-term weaning patient. The patient scenarios, on which these interviews were based on, were real and covered instances of weaning throughout the weaning trajectory, from identifying a patient as able to wean to total liberation from the ventilator. Nurses were encouraged to articulate their knowledge and skills in respiratory physiology when managing the weaning patient, so as to understand how they used the information obtained.

The verbal protocol enabled access into the nurses' mind, which was depicted in the concept maps (Appendix 6.1). Analysis of concept maps revealed that the different decisions incorporated a course of information acquisition and processing with hypothesis generation and evaluation until a final decision was made. These processes are basic elements of the human problem solving (Newell and Simon, 1972). However, analysis of fieldnotes demonstrated behaviours that suggested the activation of an unconscious, intuitive approach. Nurses moved flexibly between the two thinking processes according to the nature of the decision task and problem solving (Hamm, 1988; Thompson, 1999).

According to Lakoff and Johnson (1999), 95% of human thought is unconscious. Participant observation revealed that decisions regarding the management of the patient's secretions, instances of desaturation, anxiety, pain and respiratory distress were resolved instantaneously. Nurses were prompted to talk about these decisions in their reflective interviews, which revealed that they used a level of pattern recognition when faced with familiar patient problems, such as, when the patient had frequent episodes of respiratory distress due to secretion retention or when agitated after reduction of ventilatory support and sedation. In these cases, nurses' behaviour was a product of intuitive judgment, referred as heuristic reasoning, where inferences were based on simplifying principles as similarity and contiguity (Kahneman and Frederick, 2002; Ferreira, et al., 2006). This process was activated by observing the appropriate triggering cues involved in the case represented and was apparent in the cases that the patients were on a pre-weaning or weaning phase (concept maps B, C, E, F, G, I, J).

On the other hand, when nurses decided about changing the ventilatory settings to progress from a pre-weaning phase to a weaning phase and to a trial of spontaneous breathing or when uncertain about their decision, they seemed to activate a slow, scientific, hypothetico-deductive approach to assist their reasoning and clinical decision-making. Subtle changes of the ventilatory settings did not require immediate actions, therefore, nurses had adequate time to process and analyse the information collected (Ferreira, et al., 2006). In these cases, the inferential process was based on rules structured by logic, which were put to work strategically according to nurses' goals; that was to reduce the ventilatory support to a determined level (Kahneman, 2003). Nurses focused on the particular concepts of gas exchange, work of breathing and level of consciousness and adopted a conservative approach to the reduction of the ventilatory support.

A common characteristic of nurses' cognitive process, illustrated from analysis of concept maps, was their ability to categorise the attributes obtained from assessment in order to reduce the complexity of the decision task and to classify concepts that described weaning instances. This ability of '*chunking*' or classifying information into concepts has been suggested by many studies (Smith and Medin, 1981; Fonteyn, 1991b; Aitken, 2000). Dowding (2001) suggested that by classifying information in this way, individuals are able to access all the knowledge they have and use it to make inferences about attributes, and to make hypotheses about future events (Lingle, et al., 1984; Ross and Spalding, 1994). Nurses demonstrated the ability of '*chunking*' in both complex and less complex decisions, which allowed them to plan patient care.

The level of academic expertise of nurses could provide an explanation of nurses' skill to integrate various cues that led to a hypothesis generation. It should be mentioned that all Greek nurses were graduates of a Nursing Degree and two had a specialised qualification, while six out of eight Scottish nurses had a Nursing Degree and all, but one, had a critical care certificate. Clearly, an advanced level of education arms nurses with a profound knowledge of respiratory physiology and plays a crucial role in building the ability of discerning the objective criteria,

supported by theoretical knowledge, that are important for making weaning decisions. Both Scottish and Greek nurses searched for defining attributes of respiratory physiology, which indicated this advanced level of theoretical knowledge.

The role of an advanced level of pre-registration education on nurses' decision-making has been supported by Bakalis (2007), who studied the quality of coronary care nurses in England and Greece in the acute and recovery phase of Myocardial Infarction (MI). He showed that English nurses made better quality decisions during the recovery phase of MI than their Greek colleagues, and explained that the variation in scores was due to differences in the nursing curriculum, and specifically in nursing content, teaching methods and teachers' qualifications.

Both Scottish and Greek critical care nurses used a variety of cues to make a decision, derived from technological means, such as monitors and ventilators and clinical tests, but also from clinical assessment, such as observation of the patients' breathing pattern, the use of accessory muscles to describe respiratory fatigue, coughing reflex and quality and quantity of secretions. This finding is in contrast with Aitken's (2000) study on expert critical care nurses' use of pulmonary artery monitoring to make decisions on the patients' haemodynamic condition. Using verbal protocol, eight expert nurses articulated their decisions in real practice. One of the outcomes of Aitken's study was that most of their decisions were based on attributes derived from the monitor, whereas the use of clinical assessment was very limited.

This difference may be related to the nature of the decision task. For instance, mechanical ventilation and weaning is a process in which the active participation of the patient is crucial, in particular during spontaneous breathing trials and extubation. Clinical signs of respiratory fatigue are immediately obvious to the clinician and precipitate an immediate decision and action, contrary to the clinical signs of haemodynamic stability that may have a slow and gradual presentation. Therefore, observation of clinical signs, such as coughing, use of accessory muscles, deep breathing, level of alertness were immediately observed by the nurses and guided



their clinical decisions. This was particularly obvious in the emergency situation (concept map K) when the patient suddenly showed signs of respiratory distress.

A common characteristic drawn from analysis of the concept maps was that nurses attained similar concepts, but not all concepts involved the same attributes. Moreover, not all concepts were involved in all concept maps. Concepts related mainly to the breathing effort of the patient, but were also linked to the haemodynamic stability and level of consciousness of the patient. Adequate gas exchange, effortless breathing pattern, spontaneous breaths and increased alertness were dominant concepts to identify a weanable patient and instigate the decision to reduce the ventilatory support. Concepts and their defining attributes were not linked together in a linear manner but rather decision-making revolved around several concepts. This finding is in accordance with Aitken's (2000) study on nurses' decision-making of pulmonary artery pressure assessment that was mentioned earlier, and signifies that critical care nurses use central concepts that describe a phenomenon as a focal framework to process the information obtained in order to reduce the strain of cognitive process and arrive at a decision.

Whilst all nurses organised their thinking around these concepts, the attributes they allocated and their values differed according to their level of experience. Nurses with more than 6 years of experience, and three nurses (two Scottish and one Greek) with less than 5 years of experience, collected cues from a holistic assessment of the patient, but focused, predominantly, on the most critical aspects to identify the ability or not of the patient to wean. This is a characteristic that nurses demonstrated when talking about decisions to perform a trial of spontaneous breathing or extubate a patient. Those professionals were highly selective in their data acquisition, which is a characteristic of expert clinicians (Guyton-Simmons and Ehrmin, 1994).

A main difference between the experienced (more than 6 years of professional experience) and less experienced nurses (less than 5 years of professional experience) was that the latter focused mainly on objective criteria of weaning rather than clinical assessment to attain the concept of a '*weanable patient*'. More experienced nurses showed the mental ability to combine attributes derived from

observation of the monitors or from blood gas analysis with attributes from clinical assessment to support the judgment of respiratory distress and make a decision about its management. This difference supports the influence of experience in the collection of data to inform decision-making.

The above finding is in contrast with Junnola, et al.'s (2002) study on community nurses' assessment of pain for cancer patients. Junnola, et al. (2002) showed no association of professional experience with the acquisition of information or the definition of problems. However, they acknowledged that nurses were capable of integrating information from various different sources, such as the patient, their field of specialism, the patient's diagnosis and worked flexibly to define the problems of the patients.

According to Lauri, et al. (2001), the role of experience in decision-making varies in different fields of nursing. In the current study, it appeared that there was association of professional experience with the type of information that nurses collected to make hypotheses about the ability of the patient to sustain reductions of ventilatory support, trials of spontaneous breathing and extubation. Whilst the type of data collected by nurses is influenced by their experience, in this study, the two Scottish nurses and one Greek, who had less than five years of experience, demonstrated a remarkable ability to discriminate defining attributes of weaning and classify them to the particular concepts attained from both objective and subjective assessment. This skill, though a characteristic of expert clinical practice, indicates that novice nurses may demonstrate an advanced level of clinical judgment.

This finding generates controversy about the nature and legitimacy of evidence and knowledge gained through experience and their use in clinical decision-making. Whilst the behaviour of the three novice nurses could be considered exceptional, it stresses the need for further investigation of advanced novice nurses' decision-making processes and raises the idea for teaching those nurses how to become excellent decision-makers at an early stage in their career. Gaeth and Shanteau (1984) supported that a critical cognitive skill can be taught with interactive training which focuses on irrelevance and accuracy.

Indeed, other authors who have used simulations to describe diagnostic reasoning and planning processes for nurses showed that a greater clinical experience does not necessarily cause clinicians to converge on an optimal diagnostic strategy (Ferrand, et al., 1982; Tanner, et al., 1987; Rashotte and Carnevale, 2004). This was also confirmed in Offredy's (1998, 2000) studies, which examined Nurse Practitioners' and doctors' decision-making processes, who did not make always the right decision despite their level of experience. The inference made is that other features, apart from theoretical knowledge and professional experience, are extant of an expert nurse.

The fact that both Scottish and Greek nurses with a range of experience were able to categorise attributes to define weaning concepts is associated with patterns of knowing that are unconscious, holistic and intuitive and are explained with the dual process theories of cognition (Paley, et al., 2007). Carper (1978), in her classic paper, distinguished between '*empirics*' or '*scientific knowledge*', on one hand, and '*aesthetic knowing*', '*personal knowing*', and '*moral knowing*' on the other hand.

On the same concept, Bunge (1983a, b) outlined three principle categories as modes of knowing, all of which can be required for skilful performance of decision-making (Mahner and Bunge, 1997). Sensory-motor knowledge, in the case of managing weaning patients, includes knowing how to diminish the depth of the patient's discomfort when mobilising from the bed to the chair. Perceptual knowledge includes knowing what the various auditory cues sound like through the stethoscope or what resistances to suctioning or manual ventilation feel like, and be able to link them to specific physiological disturbances and problems. Conceptual knowledge includes knowing the pertinent biomedical theory, such as knowing that an infectious process causes various changes in the colour and consistency of secretions.

The sensory-motor and perceptual modes of knowing can consist of what is called tacit, intuitive or implicit knowledge, which the decision-maker does not know in a conscious explicit manner (Rashotte and Carnevale, 2004). Nurses in this study demonstrated a great use of this type of knowledge in their decision-making, which was observed during fieldwork. For Bunge (1983a) tacit knowledge is a real form of

knowing, but asserts that is insufficient without the conceptual, more explicit knowing. He declares that implicit knowledge needs to become explicit and conceptual to strengthen the truth claims of diagnostic inferences (Mahner and Bunge, 1997).

Moving on with the general characteristics of nurses' decision-making, many of nurses' decisions during the weaning process had an element of uncertainty. In particular the decision to extubate the patient, but also decisions about reducing the ventilatory support during the weaning phase were of significant concern for both Scottish and Greek nurses. In such cases, Scottish nurses seemed to refer to the medical staff for advice, whereas Greek nurses left the entire decision to the doctors.

In judgments under uncertainty, both Scottish and Greek nurses activated an analytic thinking process, when asked to verbalise their thoughts. However, their behaviour suggested the use of heuristic reasoning and a blunt dissociation with analytic reasoning, which has been supported in several studies of reasoning under uncertainty (Ajzen, 1977; Bar-Hillel, 1979, 1980; Tversky and Kahneman, 1974, 1982; Ferreira, et al., 2006). Analysis of the reflective interviews demonstrated the use of errors and biases in nurses' inferential thinking, which have been thoroughly studied in research on judgment under uncertainty (Kahneman and Tversky, 1972, 1973; Tversky and Kahneman, 1971, 1973, 1974; Croskerry, 2003). Croskerry (2003) referred to those biases as cognitive dispositions to respond (CDRs) and advocated that these are responsible for diagnostic errors in medicine. Most research on cognitive biases and heuristics in clinical settings involves medical diagnoses (Kovacs and Croskerry, 1999; Croskerry, 2002; Croskerry and Wears, 2002). The nursing literature lacks of investigation of cognitive biases in nurses' clinical decision-making.

In this study, two most frequent CDRs were observed in nurses' clinical judgment and behaviour. These were the anchoring bias, usually compounded by the confirmation bias and the availability heuristic. The anchoring bias was observed in cases of long periods of weaning inactivity (patient cases 1, 2, 3, 4, 5, 7, 10, 12, 15, 16, 17, 19). Less experienced nurses tended to lock onto salient features in the

patient's initial presentation of gas exchange that did not allow reduction of ventilatory support, in particular, when PaCO<sub>2</sub> and PaO<sub>2</sub> levels differed significantly from the pre-determined threshold levels. Nurses, who were not confident with weaning practice, refrained from reducing the ventilatory support even when gas exchange improved or when other attributes, such as respiratory rate, breathing pattern or saturation of oxygen confirmed the decision to reduce the respiratory support. Such behaviour was relevant to nurses' confidence of weaning practice and could explain the delays of ventilatory support reduction that occurred in most cases and led to weaning inactivity.

The availability heuristic was present when recent experience of the nurse with the weaning patient disposed attributes that readily came to mind and led to a decision. That was observed in concept maps C, E, F, G, H, I, J, K and L, when the nurse attained attributes that described the concept knowledge of the patient. An example was the knowledge that the patient was not able to sustain a trial of spontaneous breathing (concept map J); therefore, the nurse avoided another trial. Such behaviour also resulted in weaning inactivity. The findings suggested that heuristics and biases in nursing clinical reasoning and decision-making are crucial to the understanding of their cognitive process, but the findings were not conclusive. Therefore, further research is required with specifically focused questions on identifying cognitive biases in clinical decision-making.

Analysis of fieldnotes and interviews showed that behaviour under uncertainty was intertwined with nurses' level of confidence and their personality. Less confident nurses avoided taking responsibility of the decision, and delegated the task to the medical staff. More confident nurses, when uncertain, communicated their concern to the medical staff and anticipated approval of their judgment. The level of confidence was not relative to the level of experience and education, since nurses who had many years of experience were observed, frequently, to avoid making independent decisions and taking responsibility of. This reluctant behaviour was due to factors related to the inter-professional relationships, the level of support and the authority in decision-making, which are discussed in section 9.3.

Further discussion follows on the attainment of weaning concepts and hypothesis formation in weaning problem solving.

#### 9.2.2 ATTRIBUTES ACQUIRED AND CONCEPTS ATTAINED WHEN WEANING LONG-TERM VENTILATED PATIENTS

Analysis of concept maps revealed that nurses attained eight concepts in the problem solving effort to manage the patients' weaning. The attainment of these concepts aimed at increasing nurses' situation awareness of the patients' respiratory condition and weaning capability in order to classify the patient as weanable and decide on reductions of ventilatory support. The decisions made involved adjustments of ventilatory settings, performing trials of spontaneous breathing, extubation, mobilising the patient and providing physiotherapy.

Different attributes descriptive of the concepts attained were used to confirm or reject a hypothesis made by nurses in each stage of the weaning process. For instance, for the decision to initiate weaning, therefore make a transition from the pre-weaning phase to the weaning phase, the dominant criteria were the patients' GCS and ability to take spontaneous breaths. During the weaning phase and extubation, more and different attributes were involved to describe the concept of a weanable patient, which were also adjusted to each particular patient case. It seemed that the ability to cough and the amount and quality of secretions were dominant criteria for nurses to instigate the decision for extubation. These criteria are well supported in the literature of outlining predictors of successful weaning (Khamiees, et al., 2001; Smina, et al., 2003).

Gas exchange, work of breathing and level of consciousness were the focusing concepts attained by all nurses. However, not all concepts were included in the thirteen concept maps. Nurses' conceptual behaviour was characterised by a regular search for attributes that defined these concepts. Each of these broad concepts had a number of sub-concepts; for instance, hypoxia, hypercapnia and adequate gas exchange; comfortable or laborious breathing pattern; being alert and orientated or

being drowsy or agitated. Each of these sub-concepts were defined by attributes that were either positive, exemplifying the concept or negative, negating the concept. For instance, a patient who obeyed commands when asked to squeeze the nurses' hand was considered awake, and this information was used as a positive exemplar that defined the concept '*being alert and orientated*'. However, when the patient was combative, this information was a negative instance to define the above concept. Such information defined the concept of the level of consciousness and determined clinical behaviour relative to the management of sedation. A characteristic example was patient 12 who demonstrated a variation of his level of consciousness and required a specific sedation management.

Nurses used predominantly information from assessment that was exemplar of the concept. Indeed, positive information is more efficiently used in concept attainment than is negative information (Hovland and Weiss, 1953; Bruner, Goodnow and Austin, 1956). This behaviour could be explained by the fact that negative information is usually distrusted, because of the increased risk of error that the decision-maker cannot be aware of (Donaldson, 1959). Such cases were apparent in attempts of extubation, when the respiratory criteria observed confirmed the presumption that the patient was able to be extubated, but the negative information derived from the assessment of the consciousness level did not allow a conclusive decision (concept map H). In that particular case, the nurse allowed time for the patient to become more alert and cooperative, and re-tested the hypothesis.

Nurses seemed to focus more on the value of the attributes rather than the number. These values were compared to thresholds set mainly by the medical staff. However, previous knowledge of the patient, from nursing reports, medical history or previous acquaintance with the patient, influenced the decision to set the threshold value of the specific cue. A characteristic example was the adjustment of the higher acceptable level of PaCO<sub>2</sub> value for the patients with Chronic Obstructive Pulmonary Disease (COPD). Nurses were keen to accept a value of less than 8 or 9kPa in order to increase the flexibility in reducing the ventilatory support. Permissive hypercapnia has been justified in previous research (Pierson, 1990) for

the management of weaning of long-term ventilated patients and COPD patients. This was also an exemplar of the representativeness heuristic (Croskerry, 2002) used by nurses to help them process the signs and symptoms of a COPD patient and decide on reducing the ventilatory support. Such heuristics have been advocated in the literature of nurses' decision-making, as mentioned earlier (Dowding, 2001).

Attributes were divided between objective and subjective. Objective criteria derived from observation of the monitors, whereas subjective from clinical assessment. It appeared that both Scottish and Greek nurses used equally both types of criteria to make a judgment and continue with the patients' ventilatory weaning. However, in critical decisions, such as extubation, nurses focused more on objective values from blood gas analysis. Subjective criteria were particularly used to attain the concept of respiratory fatigue, to describe instances of the consciousness level, such as agitation, anxiety, pain and Glasgow Coma Scale (GCS), to assess the quality of secretions and to assess the patient's psychological status.

A common characteristic of nurses' decision-making, in both settings, related to some parameters of respiratory dynamics used in assessment. Parameters such as Rapid Shallow Breathing Index (RSBI), PaO<sub>2</sub>/FiO<sub>2</sub> index, Compliance Resistance Oxygen Pressure (CROP) and Oxygen Cost Of Breathing (OCOB), which have been shown to have a predictive value for weaning success (Alvisi, et al., 2000, Miwa, et al., 2003, Martinez, et al., 2003), were used by neither Scottish nor Greek nurses. Only one Scottish nurse with more than 6 years of experience mentioned the use of PaO<sub>2</sub>/FiO<sub>2</sub> index as a parameter to guide his decision to extubate the patient. A recent survey conducted by Soo-Hoo and Park (2002) in the USA showed that only 20% of the respiratory therapists reported the use of such weaning indexes. This finding illustrated that it is not the plethora of weaning indexes that can improve weaning practices but rather the understanding of how these indexes are used by the bedside nurses, as also supported by Rose and Nelson (2005).

Nurses were also asked, in the follow-up interviews, about the parameters they used to guide their weaning decisions. It appeared that weaning criteria that have been supported in the weaning literature and some have been included in their weaning



protocols were not deliberately considered. This finding confirms the data from both observation and reflective interviews and engenders a concern about the use of research evidence and application of weaning protocols in weaning decision-making. Recent studies on the accessibility of acute care nurses of research-based knowledge in the UK demonstrated that immediate colleagues (with or without research awareness) were more accessible as a source of information for reducing uncertainty than any form of evidence-based resource (Thompson, et al., 2001; McCaughan, et al., 2002; Estabrooks, et al., 2003). The applicability of weaning protocols and evidence-based guidelines is discussed further in section 9.4.

Concluding with the characteristics of concept attainment in weaning decision-making, one of the features observed in both settings was nurses' predisposition in attaining accurate attributes from assessment of the patient. When the numerical findings from observation of the monitor or the ventilator parameters changed distinctively within a short period nurses were able to distinguish with clinical assessment the accurate parameters (Gaeth and Shanteau, 1984).

Haygood and Bourne (1965) supported that subjects begin to encode relevant attributes only after an appreciable amount of practice on experimental problems, and even then only when the relevant attributes are given at the outset. Thus, accuracy of attributes is limited to those cases that the subject has attained mastery of several rules (negation, conjunction, inclusive disjunction). When the conjunctive strategy is insufficient, the subject discovers a set of partial solutions, which, taken together, permit him or her to attain a criterion. Gaeth and Shanteau (1984) advocated that this discerning ability of experienced clinicians can be acquired with the appropriate training.

### 9.2.3 HYPOTHESIS GENERATION AND DEACTIVATION DURING WEANING PRACTICE

In line with the theory of concept attainment, nurses used the attributes related to the weanability of the patient that they obtained from observation and clinical assessment and formed hypotheses that linked those attributes together. Analysis of

concept maps revealed that the attributes nurses assigned to the concepts attained were criteria individualised to each particular patient case and were categorised according to nurses' judgment, but the concepts attained were similar. However, some nurses, in particular those with less than 5 years of experience, required many more encounters before they reached the stage of certainty for attaining the concept, and therefore, make a decision, whereas more experienced nurses reached that point before their behaviour met these instances. This signified that more experienced nurses were able to identify and focus on particular criteria that led them to confirmation of their hypothesis without needing to test many instances (Gaeth and Shanteau, 1984). This behaviour characterises nurses with increased level of expertise in weaning decision-making (Benner, Tanner and Chesla, 1996).

The hypotheses made by nurses were described as a series of decisions about either further assessment of the patient and, consequently, collection of more information or completion of a decision task. The sequential decisions were always contingent on the consequences the participant foresaw and seemed reasonable. All in all, the steps nurses followed to attain a concept were successive decisions based on the hypotheses they made. The creative part in nurses' concept-attainment behaviour was the patterning of decisions according to the demands of the situations in which nurses found themselves (Bruner, Goodnow and Austin, 1956). The patterns of decisions made also reflected the changes in participants' hypotheses of prior hunches about defining attributes in the face of infirming contingencies.

There is a risk identified in pattern acquisition used by experienced decision-makers, which has been studied by Fischhoff, et al. (1977). In their experiments, they proved that when people draw a few instances of a category from memory to get an idea of the properties of the category, they may not realise that readily available examples may not be representative of the category. This occurs in cases of overconfidence on personal hunches. Characteristically, experienced nurses who performed a trial of spontaneous breathing twice a day were overconfident that the patient was able to tolerate this aggressive ventilatory reduction. However, the most recent guidelines on

weaning strategies have shown that trials twice a day do not offer any benefit on the patient's weaning effort compared to trials once a day (MacIntyre, 2007).

Wason and Johnson-Laird (1968) and later Tversky and Kahneman (1973) have shown that people have considerable confidence in their erroneous syllogistic reasoning, which is based on instances and patterns stored in memory which appear almost unconsciously. This occurs because people reconstruct their knowledge, during which process a variety of cognitive, social and motivational factors can introduce error and distortion into the output of the process (Fischhoff, et al., 1977). Croskerry (2003) names this bias '*overconfidence heuristic*'. If people are unaware of the reconstructive nature of memory and perception and cannot distinguish between assertions and inferences, they will not critically evaluate their inferred knowledge (Croskerry and Norman, 2008).

Participants generated hypotheses and subsequently made decisions until final solution of the problem task occurred. However, nurses differed in their expectations about what constitutes successful solution or successful progress in a weaning problem-solving, more simplistically how they defined the weaning problem task.

This difference characterised their behaviour when reducing the ventilatory support during the weaning phase. When nurses worked around the medical instruction '*wean as able*', different behaviours were observed and depicted the weaning approaches followed for each patient. The interpretation of '*wean as able*' depended on nurses' definition of a successful progress in weaning. For instance, some nurses viewed the positive response to the reduction of positive pressure support by 2 cmH<sub>2</sub>O within 12 hours as an efficient attempt of weaning that did not require any further thinking and decision-making. Other nurses continued making decisions with the view to reduce the ventilatory support further to the level that they perceived effective for the patient.

There are two reasons that explain the difference in this behaviour. First, the different approaches to weaning that derived from the interpretation of the '*wean as able*' instruction illustrate nicely the extent to which the objectives of the systematic

behaviour adopted by nurses differed as a function of how they defined the task. For less experienced nurses, one attempt to reduce the ventilatory support was considered adequate to achieve their task, whereas more experienced nurses appeared more proactive in weaning decision-making. The difference in the definition of a decision task has been studied and supported by psychologists (Simmel, 1953; Smedslund, 1956) who observed this distinction in participants' behaviour when allocated with a task.

Second, nurses' conceptual behaviour was driven by their '*aspiration level*', which is the word that Bruner, Goodnow and Austin (1956, p. 59) used to describe '*the depth of understanding that the subject seeks to achieve in his solution*'. This aspect has special relevance to the matter of '*knowing*' a concept behaviourally and '*knowing*' it at the level of verbal report. Many experiments in concept attainment have shown that subjects are able to distinguish exemplars from non-exemplars of a concept before being able to verbalise the defining features on which their judgments are based (Hull, 1920; Smoke, 1932; Walk, 1952; Bruner, Goodnow and Austin, 1956).

In this study, the '*behavioural attainment*' of weaning concepts presented prior to their '*verbal attainment*', particularly in patterns of decisions that were relevant to the management of sedation during the pre-weaning phase, or in trials of spontaneous breathing with T-piece or speaking valve. In a few cases of decisions relevant to reducing ventilatory support and mobilising the patient, the realisation of '*verbal concept attainment*' resulted in difference in behaviour. An example was nurses' reflection in attempting simultaneously a reduction of ventilatory support and consequent mobilisation of the patient, which resulted in respiratory distress (concept map C). Nevertheless, in most instances, nurses came up with solutions before they were able to describe the steps they used in attaining them. Thurstone (1950) suggests that this behaviour is observed in creative problem-solving, which characterises experts and is interrelated with the use of heuristics in expert clinical practice.

#### 9.2.4 VALIDATION OF ATTRIBUTES AND HYPOTHESES DURING WEANING PRACTICE

Validation of the data that described the concepts attained during assessment and management of weaning was used by all thirteen participants. The main purpose of validation of the attributes obtained and the hypotheses generated was to increase the accuracy of the information received so as to increase the certainty in their decisions. Validation of hypotheses is similar to evaluation of the hypotheses and involves collection of further data to ensure accuracy of the hypothesis generated (Bruner, Goodnow and Austin, 1956).

Validation occurred with various methods and depended on the nature of the decision task. Recourse to an ultimate criterion was used mainly when adjusting the level of FiO<sub>2</sub>. The most frequently used method of validation was test by consistency, when a before-after comparison of the value of the attribute or when comparison of similar cases occurred. The latter method was used when previous knowledge of the patient existed or when similar cases have been managed.

Decisions about weaning were usually characterised by uncertainty, as mentioned earlier. In such cases, nurses validated their hypotheses either by consensus from the medical staff or by both consensus and consistency. Such decisions related closely to extubation or the initiation of weaning. When uncertainty was present nurses evaluated their hypotheses indirectly, using trial and error behaviour. Small and incremental changes of the ventilatory settings are a reflection of this behaviour. Nurses used trial and error techniques to confirm or reject the hypothesis that the patient could tolerate small changes of the ventilator. On the contrary, direct validation of a hypothesis with re-evaluating the attribute reduced the level of uncertainty and led to more confident decisions.

#### 9.2.5 DECISION-MAKING STRATEGIES DURING WEANING FROM MECHANICAL SUPPORT

In line with the theory of concept-attainment, nurses used a variety of decision-making strategies to reach to the most appropriate decision. The task of keeping track

of possible hypotheses increased in difficulty when the number of attributes under consideration and the level of uncertainty increased. Thus, nurses searched for the appropriate manner to maximize the information yield and reduce the strain on inference and memory. According to Bruner, Goodnow and Austin (1956, p. 129) '*a good strategy consists in being able to alter hypotheses appropriately in the face of the contingencies that appear*'. These strategies permitted the confirmation or disproof of the primary hypothesis about the nature of the correct concept.

The twelve Scottish and Greek nurses, who used a focusing strategy, either Focus Gambling or a Conservative Focus strategy, focussed mainly on the concept of a weanable patient in their decision-making process. The attainment of this concept required the collection of attributes from assessment and the generation of hypotheses that linked these attributes together and confirmed the concept of the weanable patient. Using a focusing strategy (Bruner refers to it also as a wholist strategy) to arrive at the correct concept, nurses adopted a first hypothesis that was based on the whole instance initially encountered that explained the concept of the weanable patient, and then considered commonalities of the new attributes acquired with their initial hypothesis and ignored the non-relevant attributes. This was a cognitive skill that most experienced nurses, in both samples, demonstrated. The focusing strategies ensured that the initial hypothesis was modified at each step to include the information gained from the instances the nurses came across.

A focusing strategy was used by both advanced novice and experienced nurses in both samples. The difference in their cognitive process was that experienced nurses demonstrated the ability to arrive at the concept of the weanable patient with certainty sooner than the novice without the need to collect many attributes as exemplars of the concept. Experienced nurses used the first positive attribute as the focus and then selected orderly further attributes that were positive exemplars of the concept. Novice practitioners, on the other hand, required many encounters to attain the concept of the weanable patient with certainty. For both novice and experienced nurses, previous knowledge of the patient added information to the hypotheses generated.

A focusing decision-making strategy defined nurses' clinical behaviour. It was observed that nurses used a conservative approach to the reduction of the ventilatory support. This conservative approach could be explained by the fact that nurses had to make decisions under uncertainty; therefore, they tried to reach a decision by increasing the accuracy of attributes and concepts attained. A focusing strategy allowed the evaluation of hypotheses by always referring to the focus concept and resulted in obtaining more accurate information about the ability of the patient to wean. The conservative weaning approach was characterised by gradual adjustments of the ventilatory settings, based on trial and error behaviour. New information that derived from observation of the patients' reaction to these gradual changes was used as a new attribute that confirmed or negated the focus concept of the weanable patient.

Those nurses who used a Focus Gambling decision-making strategy, one Greek (concept map M) and three Scottish nurses (concept maps B, D and E), demonstrated a more confident trial and error approach, attempting changes of the ventilatory settings without always referring to attributes from blood gas analysis or seeking approval from the medical staff. Whilst such a clinical behaviour would be expected more from experienced nurses, two of the nurses who used a Focused Gambling strategy had less than 5 years of experience. This finding highlighted that experience is not always related to the decision-making strategy adopted by nurses and suggested that other factors influenced nurses' behaviour.

One of these factors was the personality of the decision-maker. Indeed, nurses B, D, E and M, who used a Focus Gambling strategy, described themselves as more proactive and independent in their decision-making. Observation of the weaning approaches of these nurses revealed a gradual reduction to a lower level of ventilatory support that enabled a trial of spontaneous breathing in two of the patients. The other two patients did not show signs of spontaneous breathing tolerance, but were weaned to a lower level of support.

However, the level of independency that these four nurses showed was limited to small and subtle adjustments of the ventilatory settings, when the decision to '*wean*

*as able*' was given by the medical staff. Key decisions, such as initiation of weaning, trial of spontaneous breathing and extubation were a medical territory, and so nurses validated their hypotheses by consensus with the medical staff when they dealt with these situations.

On the other hand, the eight nurses, five Scottish (concept maps A, C, F, G and H) and three Greek (concept maps I, J and L), who used a Conservative Focusing strategy, demonstrated a similar cognitive process to those who used a Focus Gambling strategy, but their clinical behaviour differed. Those nurses referred to blood gas analysis as a positive instance that confirmed their hypothesis but validated their hypothesis by consensus with the medical staff even for the small and subtle adjustments of the ventilatory settings. This behaviour could be explained by a lack of confidence or competence to make independent decisions and by socio-cultural factors of the critical care environment that did not encourage nurses' decision autonomy in weaning management. These factors are further discussed in the next section.

One Greek nurse used a Simultaneous Scanning strategy to deal with an emergent deterioration of the weaning patient (concept map K). She initiated her thinking by making many independent hypotheses together and used each attribute attained to deduce which hypothesis to keep. When the hypothesis was not confirmed by the subsequent attributes, she aimed to change it by referring back to all instances previously met and making modifications accordingly.

This decision-making strategy was used by the Greek nurse to increase awareness of the situation and reduce the level of uncertainty. Multiple hypotheses that generated simultaneously gave the opportunity to the nurse to reject those that were not confirmed, and deduce the one that confirmed the concept of the lack of airway patency and led to the decision to change the patient's tracheostomy. In that case, the nurse could not regulate the riskiness of the choice, which increased the level of uncertainty in decision-making. Therefore, she searched for evaluation of the hypotheses from the medical staff, in order to arrive at a final decision. This finding



demonstrates again a lack of nurses' decision autonomy and a distinction in decisions that are exclusively medical.

To sum up, both Scottish and Greek nurses demonstrated the cognitive skills to organise their thinking around specific weaning concepts so as to reduce the strain of the decision task and inform their behaviour when weaning the long-term ventilated patients. The continuous monitoring of the patients' condition and clinical assessment were a source for attributes and concepts that nurses attained to arrive at ventilation weaning decisions. A focusing strategy was a preferred method to achieve maximum information and direct validation of their judgments and also to reduce the level of uncertainty in decision-making.

The focusing decision-making strategy defined nurses' clinical behaviour. Both Scottish and Greek nurses demonstrated a conservative clinical behaviour, which was manifested in the gradual and small adjustments of the ventilatory settings. The findings of this study showed that nurses lacked decision autonomy even though they followed similar decision-making strategies. This difference was due to the clear distinction of nurses' decision territory. Key decisions of weaning, such as initiation of weaning, spontaneous breathing trials and extubation were exclusively medical, and so nurses had to rely on medical consensus to proceed with adjustments of ventilatory settings. Their decision territory remained within the small and subtle changes of the level of oxygen or the level of PS and depended on their confidence in applying those decisions in practice. Less confident nurses proceeded more conservatively with the reduction of ventilatory support. The differences in clinical behaviour had an impact on the patients' weaning trajectory, because it resulted in trial and error decisions that did not secure a consistent and efficient weaning process. This study suggested that socio-cultural factors of the critical care environment were responsible for nurses' hesitant clinical behaviour. These factors are further discussed in the following section.

### **9.3 CLINICAL ENVIRONMENT AND DECISION-MAKING DURING WEANING FROM MECHANICAL VENTILATION**

Clinical environments and in particular intensive care units, are complex, highly demanding and stressful and require nurses dealing with complicated situations, sophisticated technology and often declining resources (Bucknall, 2003). Most recent research on clinical decision-making focuses on analysing decision tasks in a simulated environment without taking into account stress and personal interactions which are frequently encountered in clinical settings. One of the aims of this study was to uncover the elements of the working environment that affected weaning decisions and nurses' behaviour.

The previous discussion about nurses' cognitive process, when making clinical decisions about the patients' weaning process, illustrated that both Scottish and Greek nurses were able to articulate their tacit knowledge offering justification for their judgments. However, nurses did not always proceed to realisation of their thinking into practice and their decisions were limited to specific decision tasks, indicating the existence of obstacles in nurses' independent decision-making. Observation of nurses' daily practice and their interactions as well as interviews with members of the ICU multidisciplinary team revealed that elements of the clinical environment affected nurses' judgments and their interpretation into clinical practice.

The main elements of the decision environment identified were teamwork and inter-professional relationships among critical care clinicians, authority in decision-making, managerial factors, such as lack of support and leadership, and elements of the daily duty structure in intensive care. In relation to teamwork, clinicians in the Scottish ICU appeared to have a more collaborative approach to patient care which was fostered in a supportive climate by the nurses at a senior and managerial level, in comparison to the Greek setting. This support lacked in the Greek setting and in combination with the increased workload and lack of resources generated competitive and unhealthy relationships which did not facilitate patient care in relation to weaning management.

The biomedical model of care in the Greek setting compared to the holistic model in the Scottish setting was another main difference, which defined the relationships and power distribution between nurses and doctors in terms of decision-making. In the Scottish environment, doctors were more accessible and flexible in involving nurses in selective parts of the weaning decision-making process. In the Greek setting, although doctors insisted in supporting nurses' independent decision-making, they were not observed to do so. Nevertheless, weaning decision-making remained a predominantly medical territory, in which nurses' role was defined by the support they received from their senior peers.

A third component of the decision-making environment that defined nurses' clinical behaviour was their perceived role in the weaning process. In both settings, nurses conceived illegal their involvement in a predominantly medical area and demonstrated a secondary role in the weaning process delegating the responsibility to the medical staff. Their reluctance to make decisions was translated into a passive clinical behaviour that influenced the weaning process. This behaviour was observed by both Scottish and Greek nurses. A small autonomy of Scottish nurses observed in adjusting the ventilatory settings was an outcome of the support they received by their leaders.

Finally, elements of the structure of the shift, the organisation of care around the clock, the increased rotation of the nursing and medical staff, nurses' allocation system, the shift pattern and the documentation forms, limited the continuation and consistency of care of the long-term ventilated patients. Each of these elements were prevalent in each setting but had variable weight. There are various reasons that explain the difference between the two settings and justify their comparison, which are discussed in this section.

### 9.3.1 TEAMWORK IN THE CRITICAL CARE ENVIRONMENT AND THE IMPACT ON WEANING DECISIONS

Inter-professional relationships between doctors and nurses and among nursing staff were a key characteristic of the working environment in both Scottish and Greek ICU and were observed during interactions throughout clinicians' daily routine, nursing reports and ward rounds. In nursing, very little is known about the impact of clinician relationships on clinical decisions (Bucknall, 2003). The findings of the study, clearly, demonstrated that inter-professional relationships had an impact on weaning decisions and, consequently, patients' weaning progress.

Previous research has shown that social interactions influence clinicians' behaviour (Hofling, et al., 1966; Bourbonnais and Bauman, 1985; Doyle, 1989; Stern, et al., 1991; Baggs, et al., 1992; Jenks, 1993; Bucknall, 2003). In this study, interactions usually occurred at a dyadic level, between two nurses or between nurse and doctor, and relied, to some extent, on the personal relationship, the personality and communication between peers, but also on the level of nursing leadership. A main characteristic of these dyadic relationships was that decisions were not made collaboratively. Analysis of the decision tasks with the Decision Episodes Tool (DET) demonstrated that only 2.52% of the decisions were made collaboratively by the Scottish clinicians and 0.31% by the Greek clinicians. This was a worrying finding relevant to the structure of teamwork in each intensive care unit.

Personnel relationships were characterised as '*collaborative*' or '*conflicting*' pairings by both Scottish and Greek nurses. Nurses highlighted that elements of trust and appreciation were embodied in '*collaborative*' pairings and usually resulted in problem solving interpreted as adjusting the ventilatory settings according to the patients' needs and weaning plans progressing in harmonious weaning decisions. However, this trusting relationship did not encourage a challenging nursing behaviour with regards to making those decisions. This relationship resulted in a convenient negotiation between the nurses and the medical staff to make subtle, small changes of the ventilatory settings based on the '*wean as able*' medical

instruction. Consequently, good pairings did not, necessarily, signify the establishment of collaborative decisions.

On the contrary, '*conflicting*' pairings were characterised by competitive behaviour from both nurses and doctors and resulted in disagreement or conflict. Such behaviours were more obvious when decisions regarding the reduction of sedation or extubation were prominent. In these cases, nurses showed either a compromised behaviour in order to avoid conflict and followed medical orders or they made their own decisions without doctors' gaze and knowledge.

Conflicting behaviours were observed in both settings and could be explained by the hegemonic medical conduct (Coombs and Ersser, 2004). Coombs and Ersser (2004), in their ethnographic study, examined nursing role in clinical decision-making in three general ICU in England and found that conflicts between nurses and doctors generated from the fact that decisions were medically dominated. This study lends support to my findings that medical hegemony continues to render nurses unable to influence substantially decision-making processes and, therefore, bring their knowledge to the decision-making process for weaning patients.

Greek nurses found their inter-professional relationships particularly antagonistic and incompatible, whereas Scottish nurses had a more positive experience of their peer interactions. Interestingly, Greek nurses described the nurse-nurse relationships as more conflicting than the nurse-doctor relationship, in contrast to their Scottish counterparts who supported that they had an outstanding collaboration among nurses.

Collaborative dyads were detected in the Scottish setting, in particular between junior and senior nurses, in cases of uncertainty about how to proceed with changes of ventilatory support. This was observed very frequently given the fact that junior nurses were allocated to look after weaning patients, while senior nurses managed more critical and unstable patients. Hedberg and Sätterlund-Larsson (2003) have also demonstrated that in circumstances of uncertainty and risk-taking nurses used each other to confirm information. This, however, was not observed in the Greek setting,

which confirms that inter-professional relationship in Greece impacted on nurses' input in decision-making.

The antagonistic nurse relationships were a reflection of the competitive working climate in the Greek ICU and of the lack of nursing leadership. Conflicting relationships between nurses have been observed little in previous studies in Greek settings. In most studies, competition occurred between medical and nursing staff. Many authors have advocated that lack of leadership can result in a competitive working environment and lack of collaboration within peers (Plati, et al., 1996; Merkouris, et al., 2003). An Australian study (Bucknall and Thomas, 1997) showed that personnel conflicts were the most frequent barrier to decision-making among critical care nurses. Although the enhancement of nurses' autonomy and professionalism has become a quite urgent issue for Greek nurses, Patiraki-Kourbani (2003) highlighted that lack of nursing leadership is a barrier to enabling nurses' involvement in decision-making and, very eloquently, described that:

*Doctors and administrators in the Greek professional environment are dominant over nurses. The authority and expertise of nurses for clinical decision-making is not recognised and nursing needs of patients receive low priority...poor multi-professional teamwork is a significant barrier to nursing professionalism.*

The above quote, clearly, suggests the need for a harmonious and supportive climate in the Greek intensive care environment to increase nurses' active participation in clinical decision-making. Research findings have accentuated the vital role of nurse managers in influencing staff nurses' involvement in decision-making, work environment and quality of working life (Kennerly, 2000; Margall and Duquette, 2000; Gould, et al., 2001; Kerfoot, 2001). Moreover, research on nurses' autonomy in decision-making has demonstrated a strong link between increased autonomy and increased job satisfaction, and consequently high quality of patient care (Boyle, et al., 1999; Chaboyer, et al., 1999, 2001; Finn, 2001). Therefore, nurse managers' leadership style that promotes autonomous behaviours of nursing professionals and

clinical supervision is central to the development of robust and collaborative nursing teams (Kosinska and Niebroj, 2003).

A comparative descriptive survey between USA, UK and Canada reported that nurses perceived supportive management an important variable to increase their involvement in patient care, whereas autocratic/non-supportive management, physicians and increased workload were barriers in nurses' authority in decision-making (Mrayyan, 2003). Mrayyan (2003) highlighted that optimum patient care can be achieved with nurse-physician collaboration, based on trust and respect, joint contributions of knowledge, skills and values. In addition, Vuorinen, et al. (2000) discussed in their study that peer support, where the nurse confirms information, serves as a reflector for nurses' actions in nursing and promotes on-the-job learning.

This interactive process, which involves education, support, counselling and evaluation of the situation in collaboration with peers, can result in the development of decision-making strategies to address weaning tasks (Hedberg and Sätterlund-Larsson, 2003). Supportive and collaborative nursing management can facilitate on-the-job learning of weaning management for the difficult-to-wean patients and promote teamwork and nurses' involvement in shared decision-making. A supportive nursing leadership can increase nurses' motivation and voice in clinical decisions about weaning processes, so as to accentuate the use of their skills and knowledge. Recommendations of how this can be achieved are presented in section 9.5.

### 9.3.2 LEGALITY AND AUTHORITY IN NURSING DECISION-MAKING

A very important element of the working environment that determined nurses' input in decision-making was their perceptions on the legality of making weaning decisions. Both Scottish and Greek nurses, unanimously, supported that changes of the ventilatory settings, decisions about initiation of weaning and extubation were not part of their nursing duties. Greek nurses avoided making such decisions, unless prompted by the medical staff and only when doctors were not present in the ward. Scottish nurses appeared to be more active in making changes of the ventilatory

settings, but always informed the doctors and sought their approval. For most Scottish and Greek nurses, involvement in weaning decisions was a product of a convenient and informal agreement with the medical staff.

The main reason that nurses provided for refraining from weaning decisions was that the Code of Professional Practice did not support their involvement in complex decision tasks such as weaning; therefore, they considered it an illegal act. However, when exploring the deeds of professional practice, neither the Greek nor the British code of professional practice state, specifically, that critical care nurses cannot make clinical decisions about the process of weaning from mechanical ventilation. The British Scope of Professional Practice (UKCC, 1996) emphasizes individual professional accountability and clinical decision-making (Bowler and Mallik, 1998). Gelsthorpe and Crocker (2004) explored the factors that influenced British nurses to commence nurse-led weaning and found that the lack of professional accountability inhibited them from making independent weaning decisions.

In the Greek clinical arena, qualified nurses, by Presidential Law (1989), have the right to practise in specific areas within their own responsibility. In Greece, other reasons, apart from the Code of Professional Practice, imposed avoidance of clinical accountability. Traditional nursing roles characterised as the '*eyes and ears*' of the doctor, loyally following instructions and reporting back, demonstrate that nursing is still dependent on medicine for knowledge and underpins its practice, which leads to lack of authority and independence in clinical decision-making (Kotsabasaki, 1998). Low authority is a persistent complaint of Greek critical care nurses (Tseroni, et al., 2000), whereas the use of nursing process and diagnosis is almost absent (Papathanassoglou, et al., 2002). Papathanassoglou, et al. (2002) stated that increased workload in combination with personnel shortage and medically-driven, task orientated care, make delineated nurses into an instrument to execute medical orders.

In their recent survey of nurses' autonomy in 53 ICUs in Greece, Papathanassoglou, et al. (2005) illustrated above average autonomy scores for technical tasks of nurses, tasks that might not be considered traditional 'nursing tasks'. Within these tasks, nurses reported that they adjusted ventilatory settings and managed weaning



procedures sometimes, but rarely did they decide about initiating weaning or extubating a patient. These findings are in accordance with the observed behaviour of nurses in the present ethnographic study. Nonetheless, Papathanassoglou, et al. (2005) used a Likert scale (Hellenic Intensive Care Nurses Autonomy, HICNA scale) to measure nursing tasks, which did not specify what adjustments nurses made on the ventilator or what weaning procedures they managed. Moreover, this scale is a novel instrument with low comparability with previously used tools; therefore, its use in extrapolating detailed autonomous nursing tasks is limited, and the increased autonomy in Papathanassoglou et al (2005) study might be a reflection of that.

Another European survey (Depasse, et al., 1998) that involved 156 European ICUs in 17 European countries reported lower frequency of titration of ventilatory adjustments and higher frequencies regarding extubation procedures. The difference in findings between these studies may be due to elements of the culture of each ICU to foster autonomous nursing decisions, which could not have been captured with a survey.

The present ethnographic study gave insight into this matter. A reason that could explain the lack of independence in nurses' weaning decisions is the continuous presence of doctors in ICU. In the Greek setting, the presence of doctors during the day shift when most of the weaning decisions and procedures were made did not generate the need for nurses to get involved. In contrast, Greek nurses reported that they felt more independent with their decision-making during the night shift, when the doctor was not present. Papathanassoglou, et al. (2005) also implied that nurses' level of authority might be due to the length of time of doctors' presence in the ward. In the Scottish setting, medical staff was always present in the ward, but nurses' involvement was more frequent than their Greek counterparts. However, their participation in ventilatory adjustments did not necessarily indicate authority in decision-making. As mentioned earlier, Scottish nurses, although prompted by the doctors for weaning interventions, always sought their approval.

The hesitation of nurses to make weaning decisions and be accountable for them, as this study suggested, generates another question related to the distribution of power

in decision-making and to what constitutes an autonomous nursing decision in weaning practice. The discrepancy between technical and decision autonomy suggests that nurses are allowed to perform specific tasks, even when that involves extubation or trial of spontaneous breathing during weaning, but it does not imply that these decisions are based on their own judgment or that they take responsibility for them. Analysis of cognitive maps, in this study, showed that nurses had this cognitive skill, but the embodied medically-orientated care and the lack of managerial support did not provide a path for implementing strategies to enhance nurses' decisional autonomy. More focused research on the nature of independent clinical decision-making and the differentiation between autonomy in technical tasks and decisional autonomy is required to address this question.

Several investigators have shown that medical dominance in critical care continues to relegate and de-value nurses' input in clinical decision-making, even in countries where nursing has achieved a professional and academic status, such as Scotland (Manias and Street, 2001; Coombs, 2003). In Greece, where nurses still strive for academic and professional recognition, phenomena of passive, covert decisions of ICU nurses are observed. Patiraki-Kourbani (2003) supported that empowering nurses to clinical decision-making may threaten the power balance in the Greek Health Care System. Papathanassoglou, et al. (2005) stated that altering the focus of educational programmes of Greek nurses to more theory-orientated curricula might provide a stronger knowledge-base and competence in clinical decision-making. The findings of this study, however, illustrated the lack of structures of the working environment to allow for expressing nurses' knowledge and expertise and having a more autonomous role in weaning practices. Such structures related to the daily routine in intensive care and are discussed in the following section.

### 9.3.3 STRUCTURES OF CLINICAL PRACTICE

Aspects of the structure of the daily clinical practice were the documentation practices, the ward round routine and shift rotation as well as the lack of resources.

Documentation of weaning decisions in the two clinical settings differed and affected the information flow among clinicians. It was striking that the Greek ICU did not have any system of formal documentation of medical and nursing decisions apart from the medical notes and the 24-hour chart, on which a small space was allocated for drug prescription. Decisions about weaning were communicated verbally.

On the contrary, in the Scottish ICU, nurses documented aspects of care on the nursing notes, their observations on the 24-hour chart, whereas doctors used the medical notes for documentation. In particular, decisions made at the ward round were documented on a yellow sticker attached to the medical notes. Weaning decisions were communicated as '*wean as able*' instructions on the yellow sticker to notify the nurses that they can start reducing the sedation level and ventilatory support according to the patient's reaction. A lack of a non-articulated or unstructured weaning plan allowed adherence to personal preferences in weaning strategies and to permitted increased inconsistency of the decisions made. A disruptive weaning strategy affects patients' respiratory drive and can cause respiratory fatigue.

Both Scottish and Greek nurses stressed the importance of proper and structured documentation of weaning approaches for two main reasons. First, a detailed weaning plan would provide them with a daily goal to reduce the ventilatory support according to the desired level for the patient. The '*wean as able*' instruction, communicated either verbally or written on a yellow sticker did not provide any structured plan about the patient's weaning approach; therefore, weaning relied on the individual ability and competence of the bedside nurse to proceed with weaning decisions. Second, a documented plan would provide a legal cover for nurses to proceed with changes of ventilatory settings. Having documented instructions gave nurses a safety umbrella to use their judgment and make decisions over the perceived medically-orientated clinical area. The need for adequate documentation of weaning decisions has been advocated by other researchers (Taylor, 2006).

Another reason related to the structures of daily routine that influenced weaning decisions was the different nurse allocation system and shift pattern in each setting.

In the Scottish setting, in particular, nurses were not allocated the same patient when working consecutive shifts and their working turnout was less regular than that of the Greek nurses. This resulted in having a different nurse every day to look after each long-term ventilated patient. Nevertheless, not all nurses had the same level of experience and competence in weaning practice, particularly as it was usually junior nurses allocated to look after weaning patients. Consequently, a lot of variability was observed in the weaning decisions of these patients, as depicted from the analysis of the weaning approaches. In contrast, there were less weaning inactivity periods in the Greek sample, which could be due to the more frequent turnout of nurses to shifts and due to the small working team.

The irregularity of nurses' allocation and rotation system stressed the necessity for establishing a documentation structure that could provide a detailed weaning plan for each patient and would promote better communication between the different nurses that looked after each patient on a daily base. Nurse managers should consider the promotion of communication aids in their policies of health service delivery (Henneman, et al., 2002).

Another aspect of the daily routine in intensive care was the structure of routine ward rounds. In both settings, the ward rounds were medically-driven and did not promote collaborative decision-making. Moreover, late ward rounds, as observed in the Scottish setting, delayed weaning decision-making and had an impact on the patients' weaning progress. Clearly, weaning decisions and plan should be made early on the day to allow adequate time for respiratory exercise and rest of the long-term ventilated patients. This study demonstrated a need for altering the ward round routine and system so as to ensure and encourage the contribution of all members of the ICU multidisciplinary team in weaning decision-making.

The next section extends the discussion on the role and applicability of weaning protocols to influence weaning decision-making and nurses' role within this process.

## **9.4 WEANING APPROACHES AND USE OF WEANING PROTOCOLS FOR LONG-TERM VENTILATED PATIENTS**

This study was conducted in two settings where there was already an implemented weaning protocol. One of the reasons for selecting these settings, as mentioned in the methodology chapter, was to understand the role of the weaning protocol in nurses' clinical decision-making when managing long-term ventilated patients. It became apparent early during observation that the weaning protocol was not applicable to the management of long-term weaning patients and that weaning was based on clinical preferences. The literature advocates the use of nurse-led weaning protocols in reducing the ventilation and weaning time (Meade, et al., 2001; Blackwood, et al., 2010); this is supported by the Modernisation Agency, Critical Care Programme (2002) that recommends their use. In this study, though, these protocols were neither nurse-led nor being actively implemented.

Nurses valued the existence of weaning protocols in supporting their decisions and increasing their authority in decision-making. Nurses' behaviour during weaning practice, as analysed in chapter seven, illustrated two distinct performances of weaning management for the long-term ventilated patients. First, the weaning practice was based on the clinical judgment of nurses and doctors as well as nurses' interpretation of the medical instruction '*wean as able*'. This suggests that even with the use of a protocol or weaning strategy, the weaning process still relies on clinical decision-making (Burns, et al., 2000; Gelsthorpe and Crocker, 2004). Second, nurses used their clinical judgment to maintain a balance in the patients' weaning management. This behaviour was also observed in Taylor's (2006) study, who examined the decision-making processes of medical and nursing staff in weaning patients from mechanical ventilation. She illustrated that maintaining a balance in the care of the weaning patient was a major concept of nurses' clinical behaviour.

In the current study, key decisions, such as initiating weaning, spontaneous breathing trials, extubation and tracheostomy formation, were, predominantly, doctor-led. Nurses were involved in implementing those decisions once made and appeared more active with small, subtle changes of the ventilatory settings. Although a

combination of techniques was used to reduce ventilatory support, nurses used a gradualist approach, which engaged in the concept of maintaining a balance. Nurses, in Taylor's (2006) study, presented a similar behaviour when patients proved difficult to wean. On the other hand, doctors appeared to be more aggressive in their weaning techniques, which in some cases proved deleterious for the weaning progress of the patient, as it resulted in respiratory fatigue and, consequently, weaning inactivity.

The interpretation of the '*wean as able*' medical instruction was manifested, in many cases particularly in the Scottish setting, with lack of consistency and sustainability in the reduction of the ventilatory settings and it depended on nurses' competence and confidence in adjusting the ventilatory support. Greek clinicians demonstrated less disparity in their weaning approaches, because weaning decisions were made, mainly, by the same medical team, who followed similar approaches to weaning. In contrast, in the Scottish setting, decisions were based on the medical team, which altered and rotated more frequently, whereas the lack of a common line for weaning long-term ventilated patients often resulted in aggressive and inconsistent alterations of ventilatory support. The lack of a joint approach to decision-making resulted in the implementation of personal preferences on the management of weaning influencing the patients' weaning progress.

The variance in the weaning approaches that were followed was assessed with the use of average weaning time, ventilation time and ICU length of stay between the samples. The median values of ICU length of stay, ventilation and weaning time varied more in the Scottish sample than in the Greek sample. Moreover, there was great difference in the time for a tracheostomy formation, with the Greek doctors supporting an early decision compared to their Scottish colleagues. Many reasons could explain this difference. First, the difference of the patient cases selected with regards to the medical history and diagnosis, would advocate diverse weaning management. In answer to this, great effort was made to select patient cases that were similar in their reason for admission to intensive care, medical history and

diagnosis. Clearly, identical cases could not be found, but the sample was selected purposively to identify patients who would require long-term ventilation.

An element of the weaning approaches that was evident in both samples was the periods of weaning inactivity, which were characterised by a high and static level of positive pressure support for more than 2 days once the patient entered the weaning phase. This phenomenon could have a twofold explanation. First, increased and plateau level of ventilatory support might demonstrate the lack of readiness of the patient to wean. In these cases, the attempted reductions of positive pressure support resulted in respiratory fatigue and consequent increase of the level of support. Moreover, the decisions to make subtle changes of ventilatory settings were based on the attributes that defined the concept of a weanable patient, mentioned in chapter six (section 6.3.7). This implies that the criteria used in weaning practice, for both samples, were not adequate to provide certainty of the patient's readiness to wean.

Walsh, et al. (2004) advocated the use of a weaning criteria list to assess the patient's readiness to initiate weaning, whereas systematic reviews of the literature on weaning have supported more sophisticated indexes for weaning success (Meade, et al., 2001; MacIntyre, 2007). These indexes were not used by the Scottish and Greek clinicians to support their judgment and decision-making, which clearly necessitates a reassessment of their practice in identifying a weanable patient at an early stage.

The effectiveness of weaning protocols in reducing weaning and ventilation time has been assessed thoroughly, in the weaning literature and demonstrated statistically significantly shorter durations of ventilation and ICU length of stay in patients receiving weaning protocols by respiratory therapists and nurses compared to those randomised to traditional physician-led weaning (Ely, et al., 1996; Kollef, et al., 1997; Malerich, et al., 2000; Schultz, et al., 2001; Randolph, et al., 2002; Krishnan, et al., 2004). It should be noted, at this stage, that most of these studies were conducted in the USA where respiratory therapists play a significantly active role in weaning practice. Such a clinical role does not exist in Europe, and, consequently, in Greece or Scotland.

Opponents of the use of weaning protocols have argued that the introduction of weaning protocols leads to repression of analytic thought, critical thinking and innovation and failure to facilitate individualised care that is required for the long-term ventilated patients (Byrnes and West, 2000; Kingston, et al., 2000). Blackwood, et al. (2004) concluded that weaning protocols are not necessary in clinical settings where clinicians review the patients frequently and enable changes in response to the patients' progress, and that they are not applicable to meet the complex and unpredictable needs of long-term ventilated patients. Both of these arguments have been supported in this study.

What most studies fail to assess when evaluating the use of weaning protocols is the impact of organisational structures and existing nursing practices in the settings under investigation. Keogh, et al. (2003) and Krishnan, et al. (2004) have demonstrated in their studies a lack of effect of weaning protocols attributed to organisational factors. This study, clearly, advocated the impact of elements of the working environment on weaning decision-making in two settings where there was an implemented weaning protocol, highlighting the need to consider these elements in future research on weaning practices.

Clearly, a systematic approach to weaning that promotes collaborative decision-making is required to tackle the complexity and uncertainty of the weaning process. Recent studies advocated the effectiveness of multidisciplinary approaches to weaning in reducing the length of weaning and ventilation time (Young, et al., 1998; Cull and Inwood, 1999; Kaye, et al., 2000; Henneman, et al., 2001; Smyrnios, et al., 2002; Grap, et al., 2003; McLean, et al., 2006). Such approaches should consider all members' contribution during communication, decision-making and teamwork, as well as elements of the working environment that impact on clinicians' behaviour (Carroll, et al., 2008). The findings of this study supported the adoption of a systematic multidisciplinary weaning approach for long-term ventilated patients, which is presented in section 9.6.1.



## 9.5 LIMITATIONS OF THE STUDY

When appraising a research project, there are certain methodological issues that a researcher is challenged to defend. Such methodological issues concern the scientific method employed to conduct the research, objectivity and bias and generalisation of findings. Fieldworkers are often accused of presenting their own subjective way in reality, therefore causing bias in the findings and not presenting the truth. To this ‘accusation’ Michael Agar responds that ‘*objectivity is perhaps best seen as a label to hide problems in the social sciences*’ (Agar, 1996, p.41).

It is very naïve to suppose that the researcher enters the field without any preconceived hypothesis or idea about the topic. In fieldwork, observation cannot proceed without knowing what to look for. For this particular study, it would have been very difficult for a researcher without previous background in intensive care to look for the reality of decisions during the weaning process and the pragmatic aspects of the field that affected decision-making (Wolcott, 1995).

According to Parahoo (2006), one of the limitations of ethnographic fieldwork include the possibility that the researcher might immerse herself in the setting and the culture that she is investigating to such extent that she cannot differentiate her own perceptions with those of participants; therefore, being unable to provide an objective, and unbiased description and analysis of the findings (Atkinson and Hammersley, 1983). This risk was particularly immense when analysing the reflective interviews with nurses, where the challenge to differentiate my own knowledge from that of the participant could have threatened the credibility of the findings.

In an effort to be objective when conducting fieldwork, the researcher needs also to remain neutral and ‘*fair*’ when interpreting the behaviour of other humans. Having likes and dislikes is human, and should not exclude someone from doing fieldwork. However, it is important to recognise and appreciate that pre-existing feelings and find a source of energy in those feelings for conducting and completing the study. I should admit that, prior to my study I had certain feelings about doctors’ behaviour

towards nurses, about the dynamics of this relationship, which derived from my experience as a critical care nurse. These feelings were more related to the Greek medical staff and their behaviour towards nurses.

In answer to these challenges and limitations, auto-ethnography proved to be an effective methodological approach to explore my views and feelings on the topic under investigation prior to entering the main field of study. Particularly, in research conducted by active clinicians, when the aim is to explore social phenomena of clinical practice, accessing own practice through auto-ethnography would increase the awareness of the impact of the self in the management and interpretation of data.

Another limitation of ethnography with regards to the use of participant observation was the risk of Hawthorne effect. In ethnographic research, the observer's presence cannot be fully eliminated but after a while the observer becomes part of the whole, of the setting, and the participants do not feel like altering their behaviour when an unfamiliar person (the researcher) is present, as he or she is integrated into their society. Munhall (2003) believes that while the Hawthorne effect is an obvious drawback, its effect in participant observation can be over-emphasized. Participants in this study were too busy while working that their behaviour was not affected by my presence, as they clearly reported at the end of their observation. Clearly, there is no perfect method and some trade-off is often necessary for the collection of valid and reliable data (Parahoo, 2006).

Generalization is another epistemological issue that needs to be considered when reflecting on a study. Usually in qualitative studies, a single case is investigated, which limits the possibility of generalising the findings to the particular population. However, a case study allows the investigation of a phenomenon in greater detail and likely accuracy of information at the cost of being less able to make effective generalisations to a larger population of cases (Hammersley, 1992a, b). Wolcott (1995) affirms that you cannot generalise from a qualitative study, because each case is unique but we can learn from it and apply its lessons more generally.

The findings from the two settings could not possibly be generalised to the population of Scottish nurses, from the findings from the Scottish setting, or to the population of Greek nurses, from the findings from the Greek setting, let alone the whole population of critical care nurses, since the sample size was small. Nevertheless, they provided details in the process of weaning from mechanical ventilation and the organisational structure and culture of ICU that impacted on clinicians' decisions, suggesting aspects of service delivery and policy that could be investigated with a larger scale study.

Finally, the focus of this study was to access nurses' mind and to capture their decision-making process when managing the weaning of long-term ventilated patients. It is possible that not all decisions were uncovered in relation to the patients' weaning, but the methodological approach followed aimed to optimise the collection of rich and in-depth data on nurses' thinking process. The combination of data collection methods, such as participant observation, reflective interviews on nurses' daily practice and complementary semi-structured interviews with members of the multidisciplinary team, were used to examine nurses' thinking process, clinical behaviour and their perceptions on decision-making practices relative to the management of long-term ventilated patients. This triangulation of data collection methods offered a strength in the quality and depth of the data collected and aimed to provide a holistic view of clinical decision-making in the real setting.

## **9.6 RECOMMENDATIONS**

The findings of this study provided clarification of the cognitive strategies that nurses used to make decisions in the field of weaning from mechanical ventilation and extubation. They also offered insight into the elements of two culturally different clinical environments, Scotland and Greece, and their impact into nurses' clinical decision-making and its interpretation in clinical practice. The fact that this study was conducted in real settings, rather than simulated, suggests that the findings could be an accurate reflection of the decision-making strategies in mechanical ventilation and weaning used by nurses with different levels of experience.

The use of concept attainment theory to analyse nurses' cognition proved valuable in increasing our understanding of tacit knowledge and its use in informing clinical decisions. Undoubtedly, the findings of this study offered insight into aspects of clinical practice that need to be addressed so as to secure safe delivery of care for long-term ventilated patients through advanced weaning practices that promote shared decision-making. They also indicated the need for educational support of critical care nurses at all levels of experience on the principles and evidence of weaning from mechanical ventilation so as to increase their confidence and autonomy in collaborative decision-making. Finally, new ideas generated for further research on weaning practices for long-term ventilated patients and nurses' clinical decision-making. These recommendations for practice, education and research are discussed below.

### **9.6.1 RECOMMENDATIONS FOR PRACTICE**

Weaning from mechanical ventilation is an essential component of each patient's recovery and discharge from intensive care. To optimise patient outcomes, recent research supports a multidisciplinary approach to weaning protocol development, implementation and review to ensure successful integration in clinical practice (Kingston, et al., 2000; Henneman, et al., 2001; Grap, et al., 2003). A recent systematic review on the effect of multidisciplinary team (MDT) implemented

weaning protocols highlighted many methodological limitations of the studies included and imposed a cautious interpretation of the findings (White, et al., 2010). A reason for this is the failure to analyse and integrate components of the multidisciplinary team that affect the daily routine of weaning practice and appreciate the role and responsibilities of each clinician involved.

The findings of this study demonstrated that there was no sustainability in the decisions to reduce ventilatory support, due to lack of communication and organisational structures to recognise the value of all members' contribution during decision-making to promote teamwork and shared decision-making. This study highlighted that developing another weaning protocol is not adequate to improve the weaning of long-term ventilated patients. Focus should be given to a culture change in intensive care that promotes shared decision-making. The findings of the study recommend that to optimise outcomes of weaning patients and advance their recovery, health teams need to create processes and structures that strengthen key stakeholders' adherence to mechanical ventilation weaning decision practices. Such an approach is suggested herein.

The approach that is proposed with the current study is the systems approach, which evolved after the Industrial Revolution of the 19<sup>th</sup> and 20<sup>th</sup> century in the fields of management, science and philosophy (Sevdalis and Brett, 2009). The term systems derives from the Greek word 'synistatai', which means combines, and, so, systems approach is the process of understanding the various elements of a whole, a system, and their interactions.

In line with this approach, the weaning practice is considered a system that incorporates the patient, the carer and the clinical environment. The systems approach considers two basic components; the elements, which are measurable and link together, such as events, patterns or structures; and the processes, which are functions or activities that change the elements from one form to another. Elements in the weaning process are the characteristics of the weaning patient, such as medical condition, pathophysiological and psychological components of the clinical condition, the characteristics of the decision-maker involved in the process, and

managerial and organisational aspects of the clinical environment that characterise the multidisciplinary team, any structures for information flow and the clinical guidelines relevant to mechanical ventilation and weaning. Processes are activities and functions that link the above elements, such as ward round and nursing report routine, and pre-determined roles for clinical decisions advocated under the existing leadership style.

Since this study identified many elements and processes that influenced weaning decisions and nurses' behaviour, the systems approach to weaning decision-making has four aims: a) to increase professional staff knowledge and skills in weaning long-term ventilated patients; b) to identify resources needed to screen for long-term ventilated patients early in their weaning process; c) to improve care communications, documentation and data collection systems; and d) to promote joint doctor/nurse leadership including professional role clarification.

This attempt should be a joint doctor/nurse leadership initiative, which will aim to develop training modules at a competence level for both doctors and nurses to enhance mechanical ventilation and weaning knowledge and skills. More details about the development of an educational programme are referred to recommendations for education (section 9.6.2).

Moreover, it is necessary, in both settings, to formulate flexible clinical guidelines for long-term ventilated patients that include early screening of weaning patients, evidence-based principles for weaning approaches stratified to specific clinical conditions, such as COPD or emphysematic patients, ARDS patients, and other long-term clinical conditions. All members of the multidisciplinary team, doctors, nurses and physiotherapists should be involved in the development of clinical guidelines.

In order to promote continuity of care, increasing the communication among members of the team is essential. The focus should be on enhancing the documentation of the patients' weaning progress and emergent situations. These communication structures should support the input of each member of the team and recognise each member's contribution in decision-making. It is suggested that

individualised weaning plans are developed and designed to depict the patients' short-term (day-to-day) and long-term (weekly) weaning progress. These individualised weaning plans should focus on daily and weekly weaning targets set by the multidisciplinary team and should include an evaluation section for documenting any adverse or emergent events. This plan will be followed by both medical staff and nurses and it is believed it will provide more consistency in the weaning strategies followed for each patient.

Finally, a shared nurse/doctor leadership in promoting collaborative decision-making for long-term ventilated patients should aim to clarify the professional roles within weaning problem solving and encourage the input of nurses' knowledge and skills. Weaning should not be considered a doctor-led task, since nurses' contribution is equally important. Maintaining a collaborative approach in implementing, evaluating and sustaining change of weaning practice is believed to increase staff morale, motivation and job satisfaction as well as patient satisfaction and quality of care. In particular, in the Greek setting, where the medical orientation of health care provision is imposing, health care stakeholders should focus on encouraging the establishment of collaborative multidisciplinary teams in intensive care.

To achieve shared decision-making, attention should be given to the structure and time of ward rounds. Decisions to initiate weaning should be made early in the morning followed by a constructive weaning plan that will be formulated with the contribution of nurses, medical staff and the physiotherapists early on the day. It is suggested that nursing staff screen the patients' readiness to wean at the end of the night shift, so that an early weaning plan is constructed in collaboration, allowing time for any changes made at the ward rounds. It is also suggested that care is organised according to the patients' needs with more flexibility on the arrangement of nursing tasks and nurses' break time.

### 9.6.2 RECOMMENDATIONS FOR EDUCATION

The findings of the study advocated the need for specialised knowledge in critical care and improvement of nurses' decision-making skills on the process of weaning from mechanical ventilation. In both settings, nurses highlighted that further education on this specialised topic would increase their confidence in autonomous decision-making. What this study proposes is the development of an integrated educational programme specifically focused on weaning from mechanical ventilation, which has never been used in either of the settings and is addressed to both nurses and medical staff.

The concept attainment theory offered an insight into the various weaning attributes and their clustering to reduce the strain of the cognitive process and memory use. It demonstrated how nurses think when making decisions under uncertainty. The reflective interviews showed that nurses became acquainted with their intuitive knowledge through verbalisation of their thinking and reflection in their practice.

It is suggested that the principles of concept attainment theory are used in the development of continuous educational programmes with the use of reflective practice. Reflective practice in clinical settings has been advocated by Schön (1983, 1987) and Argyris and Schön (1974) and involves reflection-in-action and reflection-on-action. According to the authors, humans make sense of the contexts within which they function by constructing mental representations or concepts of them and these, in turn, guide the design of actions (Greenwood, 1997). This is where the concept attainment theory can help in identifying these concepts related to weaning practice. With reflection-in-action, the nurse can make sense of the situation she or he confronts and reflect on the understandings of the implicit action, the feelings that led to the adoption of the particular action and the way she or he structured the problem. Reflection-in-action allows the nurse to restructure and redesign the problem while being in action.

Following reflection-in-action is reflection-on-action, when the nurse reviews her or his actions to explore again the understanding of the behaviour in the light of the



outcome of the action (Greenwood, 1993). According to Bound, et al. (1985), reflection entails returning back to the experience, recapturing in detail the feelings it elicited, positive or negative, and re-evaluating the experience by relating what is learnt in comparison to previous knowledge. This process is the so-called single-loop learning (Carper, 1978), which has been used in reflective practice in the UK (Greenwood, 1993) and can be applied to an educational programme to support both novice and experienced critical care nurses and doctors in clinical decision-making.

This study demonstrated the important role of the elements of the decision-making environment that impact on clinical decisions. Therefore, it is imperative to include the social structures in this learning process. The double-loop learning approach that has been used in the nursing discipline in Australia embraces reflection of the values and norms of clinical practice in the learning process (Kemmis and McTaggart, 1988). This approach advocates that reflection on the social values and relationships that underpin human action, in this case weaning practices, can facilitate the construction of more socially desirable nursing and health care reality. A combination of Carper's (1978) single-loop ways of knowing nursing and Kemmis and McTaggart (1988) analytical guidelines of critical appraisal of incidents will allow nurses to increase their understanding of and effectiveness in strategic, therapeutic action and the socio-political contexts in which it is embedded, so as to provide a high quality health-care service delivery for long-term ventilated patients.

All these elements should be included in the development of an educational programme that will be offered at a competence level and will be addressed to both nurses and medical staff. It is believed that such a programme will enhance nurses' clinical judgment and skills and will increase their confidence in making independent decisions.

### 9.6.3 RECOMMENDATIONS FOR RESEARCH

The discussion of the findings of this study highlighted some areas of clinical decision-making and weaning practices that demand further research. To start with,

critical care nurses' decision-making during weaning practices has been limited to identifying the gold standard for weaning indexes and modes of ventilation. This study suggested that weaning should not be viewed as an isolated decision task but as part of a system where socio-cultural factors are very influential.

Future study should focus on the investigation of inter-professional relationships within the ICU setting and leadership approaches that improve teamwork and promote patient-centred care. The ethnographic approach can be employed to explore further aspects of the clinical environment that impact on decision-making and can be used to inform intervention studies that aim to change health care service delivery in intensive care.

Such an intervention study is suggested as an outcome of this research. The suggested future research programme will involve the development of a weaning focused education programme for nurses and medical staff, the development of a structured documentation strategy for long-term weaning patients to improve information flow among staff, the development of evidence-based weaning guidelines stratified to specific patient cases that require long-term ventilation. These elements, developed within a multidisciplinary spirit, will be tested against the usual care in a larger intervention study to show an impact on reducing ventilation and weaning time and ICU stay time. An action research approach could be used to understand the adherence of staff on the intervention and its embedment in the culture of intensive care. It is believed that such an intervention will enhance nurses' role in weaning practices and will increase staff satisfaction.

Finally, the use of reflective interviews to access nurses' mind and extrapolate their thinking processes can be useful in exploring further real-time clinical decision-making focusing on the process of information and use of knowledge by experienced and less experienced nurses. Additional research using the verbalisation protocols in the natural settings in combination with participant observation is necessary to understand the impact of heuristics and biases on clinical behaviour and consequently practice. Understanding their impact on patient care will allow the

development and refinement of techniques to improve nurses' clinical judgment and decision-making.

## 9.7 CONCLUSION

Critical care nurses make a vast amount of decisions when caring for long-term ventilated patients, but frequently they do not realise the importance of their contribution to the patients' progress. The decision-making processes discussed in this chapter demonstrated knowledge of a wide range of attributes and concepts relevant to mechanical ventilation and weaning, which were embodied in nurses' daily clinical behaviour. Whilst decision-making is a cognitive process and so specific to mental construction of humans, it is dependent on the complexity of the decision task but also on aspects of the decision-making environment.

When describing how nurses use information to direct their patient care and ultimately improve patient management, in this case weaning management, researchers should consider aspects of the clinical environment that impact on nurses' behaviour. The challenge in studying decision-making practices in real settings is great, but also essential if the goal is to provide a complete understanding of clinical phenomena and improve health care service delivery.

Whether the principles of decision-making processes identified in this study reflect critical care nurses' practices is not conclusive. Weaning practice is a small area of clinical decision-making but, yet, crucial for the management of critically ill patients; therefore, it requires advanced skills of clinical judgment, which can be enhanced by understanding the impact of human factors in clinical decisions of experienced nurses. More work needs to be done to improve critical care nurses' skills and increase their involvement in clinical decisions.

# CHAPTER TEN

# CONCLUSIONS

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### **CONCLUSIONS**

The recognition of critical care as a separate speciality is linked to the advanced life support technology, truly defined by the use of mechanical ventilation. Many acute and chronic diseases can result in inefficiency of the respiratory system to provide adequate oxygenation of the lungs and thus constitute a life threatening situation for critically ill patients. Whilst the majority of these patients receive mechanical ventilation for a short duration and can easily be disconnected from it, a significant number require prolonged ventilatory support and cannot tolerate removal from the ventilator, despite resolution of the initial process that prompted its use in the first place. In an effort to decrease costs, reduce the risk of Ventilatory Associated Pneumonia and improve patient outcomes, emphasis has been put to the development of weaning protocols to facilitate clinicians' decision-making during the weaning process from mechanical ventilation. Although most research has added greatly to our understanding of the weaning process, we continue to struggle with questions of how and when to wean.

Weaning practice requires that bedside nurses continually make decisions about the patients' ventilation management. The ability to make clinical judgments involves a complex process using both domain-specific knowledge and decision-making methods. Although decision-making is central to the discipline of nursing, there is limited understanding of how critical care nurses use assessment information to direct patient care and improve weaning management, and how various socio-cultural factors impact on the decision-making process and define clinical behaviour.

The current study gave insight into critical care nurses' decision-making strategies to solve complex decisions of weaning from mechanical ventilation and provided a deep and accurate understanding of the impact of the dynamics of the decision-making environment on nurses' clinical decisions and behaviour. The combination of data collection methods, including participant observation, reflective interviews,

chart review and complementary follow-up interviews, provided a comprehensive way to capture in depth information and was the strength of this study. The ethnographic methodological design enabled the profound examination of contextual factors of the real clinical environment, such as limited time, increased ambiguity, constant situation changes, far-reaching responsibility of decisions, working relationships that influenced the decision-making process and its outcome. Thematic analysis of the data revealed the main concepts that critical care nurses used to inform their decisions and clinical behaviour and highlighted the elements of the practice environment that influenced those decisions. The concept attainment theory was used as a theoretical framework to analyse in depth nurses' decision-making strategies with the use of concept maps.

One of the main findings of the study related to the nurses' cognition. Nurses, in both settings, demonstrated advanced cognitive skills to acquire a substantial amount of data or attributes, which they clustered around eight concepts related to the weaning process, with the most prevalent being gas exchange, work of breathing and level of consciousness. Hypotheses were made to link the attributes to the concepts, which were then validated to increase the accuracy in the decision-making process. These hypotheses informed further the concept of a '*weanable*' patient. Nurses, in their majority, used focusing decision-making strategies, such as Focus Gambling and Conservative Focusing, whereas only one nurse used a Simultaneous Scanning strategy. Scottish and Greek critical care nurses adopted similar decision-making strategies, despite differences in their experience, but this finding could not draw a conclusion on the impact of experience on the decision-making strategy selected.

By using a focusing strategy, nurses focused on the concept of a '*weanable*' patient to reduce the strain of the decision task. Further information they collected from the patients' reactions to ventilatory reductions was added to generate new hypotheses that were validated by consistency or consensus to lead to accurate decisions of weaning. The focusing strategy defined a trial and error approach that was manifested by small, gradual alterations of the ventilatory settings. Nurses who used a Focus Gambling strategy were observed to be more proactive in their trial and error

decisions compared to those who used a Conservative Focusing strategy. The latter were also observed to validate their hypotheses by consensus with the medical staff more often than those who adopted a Focus Gambling strategy.

The Simultaneous Scanning strategy was used when the nurse confronted a sudden, life-threatening situation which cause was unclear. This strategy was used by an advanced novice nurse, but was not conclusive to novice nurses' thinking process. It showed a difference in nurses' thinking processes when dealing with tentative situations.

An important finding was that nurses, both experienced and advanced novices, used pattern recognition when managing the patients' secretions, episodes of sudden hypoxia, and issues of anxiety, pain and respiratory distress. They collected information from clinical assessment and observation but also from previous knowledge of the patient. Intuitive judgment was activated when nurses observed triggering cues and made inferences based on principles of similarity and contiguity. In decisions about subtle changes of the ventilatory settings that did not require immediate actions, nurses used a hypothetico-deductive approach to reason their decision and reduce the ventilatory support to a determined level. Nurses moved flexibly between an analytic mental process and an intuitive process, depending on the nature of the decision task.

Both Greek and Scottish critical care nurses demonstrated a conservative approach to weaning long-term ventilated patients, as an outcome of their cognitive process. The main difference was that Scottish nurses appeared more active in adjusting the ventilatory settings compared to their Greek colleagues. Nurses' clinical behaviour was limited to subtle changes of the ventilatory settings that depended on their clinical judgment and interpretation of the medical instruction wean as able, since there was no pre-defined and structured weaning plan that could inform decision-making. Their role was to maintain a balance in mechanical ventilation management, sedation management, physiotherapy and patient mobilisation.



Key decisions relative to initiating weaning, sedation interruption, performing spontaneous breathing trials and extubation were predominantly doctor-led in both settings. Yet, even within their decision territory, critical care nurses showed a lack of decision autonomy, which was relevant to socio-cultural elements of the decision-making environment. These elements explained the commonalities and main differences between Greek and Scottish nurses in their decision-making.

A commonality between the settings was the lack of shared decision-making culture. Nurses did not have an equal to medical staff input in decisions about weaning. They were not encouraged to make more than subtle and small changes of the ventilatory support, and their decisions were based on delegated responsibility under the medical instructions. Both Scottish and Greek nurses demonstrated an increased competence but very limited decision autonomy, which was a consequence of their perceived role in weaning management, of the structures of communication, of the support they received at a managerial level, and of their working relationships.

Nurses in both settings did not perceive weaning to be part of their clinical role and duty. They have assigned it as a medical responsibility and felt the need to be legally covered even for the small alterations of ventilatory support. This finding was supported in both settings.

Second, the lack of adequate documentation of the weaning plan did not provide nurses with a detailed approach to weaning and deprived them from a legal cover that would provide authority in their decision-making. This reason made them hesitant to express increased decision autonomy during the weaning process.

The lack of a structure of documentation and communication of the weaning practices resulted in the lack of a standard, consistent and individualised approach to the management of long-term ventilated patients. Consequently, weaning management depended on medical preferences and on nurses' clinical competence and confidence, resulting in long periods of unreasonable weaning inactivity and irregular variance of ventilatory adjustments.

Working relationships, among nurses and between nurses and doctors, played a significant role in nurses' clinical behaviour. Conflicting working relationships did not allow effective communication among clinicians and created a competitive climate in which nurses adopted a passive role in decision-making. This was more prevalent in the Greek setting and explained the difference in nurses' clinical behaviour with their Scottish counterparts. The small independent decision activity observed by Scottish nurses was an outcome of a supportive behaviour by senior nurses.

In summary, although both Scottish and Greek nurses demonstrated an advanced cognitive ability to make complex decisions in problem solving when weaning from mechanical ventilation, they expressed a passive clinical behaviour. Elements of the decision environment did not encourage teamwork and shared decision-making that could lead to consistency and progress in weaning strategies and could leave nurses with space for autonomy in their part of the weaning process.

Whilst the findings of this study were not conclusive to the care of weaning patients since they were representative of the small sample selected, they highlighted the need for improvement of health care service delivery in the management of long-term ventilated patients. Further research in the field should focus on quality improvement innovative studies for the management of long-term ventilated patients in the acute phase.

The current study proposes an innovative approach to the management of these patients with the development and implementation of multidisciplinary team (MDT) weaning approaches individualised to the needs of each long-term ventilated patient. The equal input of all members of the team in the development, implementation and evaluation of MDT weaning approaches is pivotal. Clinical leadership promoting the implementation and adherence to the weaning approaches through policy development is required to ensure that reductions in mechanical ventilation duration occur. Clinical leadership should target the development of a culture in intensive care that encourages nurses' decision-making autonomy. Finally, to enhance nurses' decision autonomy, we should develop educational programmes on mechanical

ventilation and weaning management to improve their decision-making strategies and their skills in making accurate and high-quality clinical decisions.

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# APPENDICES

## GLOSSARY

| WORD/ABBREVIATION | EXPLANATION   |
|-------------------|---|
| <b>ABG</b>        | Arterial Blood Gas measured by an analyzer.   |
| <b>AF</b>         | Atrial Fibrillation is an irregular heart rhythm, in which there is absence of P wave on the electrocardiogram (ECG).   |
| <b>Alfentanil</b> | It is a short acting synthetic opioid analgesic drug used for anaesthesia. It tends to cause less cardiovascular complications than remifentanil or fentanyl and give stronger respiratory depression. That is why it should be used carefully. |
| <b>ARDS</b>       | Acute Respiratory Distress Syndrome.  |
| <b>ARF</b>        | Acute Renal Failure.  |
| <b>Atracurium</b> | It is a neuromuscular-blocking drug causing muscle relaxation. It is used in general anaesthesia to facilitate endotracheal intubation and to provide muscle relaxation during mechanical ventilation and surgery.                              |
| <b>BAL</b>        | Bronchial Airway Lavage, a method of washing out the deep airways from secretions.  |
| <b>BE</b>         | Base Excess is used to assess the metabolic component of acid-base disorders. Negative BE indicates that the patient has metabolic acidosis and positive BE indicates metabolic alkalosis. Range: -3 to +3mmol/l.                               |
| <b>BiPAP</b>      | Biphasic Positive Airway Pressure is an assisted model of ventilation in which a pressure limit breath is delivered at a set rate.  |
| <b>BP</b>         | Blood Pressure is the pressure in the large arteries measured in mmHg.  |
| <b>COPD</b>       | Chronic Obstructive Pulmonary Disease.  |
| <b>CPAP</b>       | Continuous Positive Airway Pressure is a model of ventilation in which positive pressure is applied at the end of expiration.   |
| <b>CVVH</b>       | Continuous Veno-Venous Haemofiltration used in the treatment of patients with acute renal failure as part of  |

|                                    |  |
|------------------------------------|--|
|                                    | multi organ dysfunction syndrome.  |
| <b>CXR</b>                         | Chest X-Ray.   |
| <b>Diprivan</b>                    | See propofol.  |
| <b>EtCO<sub>2</sub></b>            | End-tidal carbon dioxide concentration is the maximum concentration of carbon dioxide in the alveoli at the end of expiration. Normally it is 5% or 35-37mmHg.   |
| <b>ET tube</b>                     | Endotracheal tube  |
| <b>f</b>                           | Respiratory Rate or frequency of breaths per minute.   |
| <b>FiO<sub>2</sub></b>             | Fraction of Inspired Oxygen in a gas mixture delivered by the ventilator. In room air the FiO <sub>2</sub> is 0.21 or 21%.   |
| <b>GCS</b>                         | Glasgow Coma Scale, it is a tool used to assess the patient's consciousness level. It is measured in a scale of 3 to 15 assessing the best response of the patient in stimuli.   |
| <b>Haloperidol</b>                 | It is an antipsychotic drug used for treatment of psychotic states and delirium.   |
| <b>HCO<sub>3</sub><sup>-</sup></b> | Bicarbonate ion indicates a metabolic problem. Low HCO <sub>3</sub> <sup>-</sup> indicates metabolic acidosis and high HCO <sub>3</sub> <sup>-</sup> indicates metabolic alkalosis. Range: 22-26mmol/l.                              |
| <b>HR</b>                          | Heart Rate is the heart beats per minute. Normal for adults is 60-101beats per minute.   |
| <b>Inotrope</b>                    | It is an agent drug that alters the force of muscle contractility. Negative inotropic drugs weaken the force of the heart muscle contractions while positive inotropic drugs increase the strength of the heart muscle contractions. |
| <b>MAP</b>                         | Mean Arterial Pressure is the average pressure over a cardiac cycle.   |
| <b>Midazolam</b>                   | It is a short-acting benzodiazepine derivative drug, which has powerful anxiolytic, amnestic, hypnotic, anticonvulsant, skeletal muscle relaxant and sedative properties. Brand name is Dormicum.                                    |
| <b>Morphine</b>                    | It is an opiate analgesic drug, which acts directly to the central nervous system to relieve pain.   |
| <b>NG tube</b>                     | Nasogastric tube used to feed the critical ill patient.  |

|                                  |   |
|----------------------------------|---|
| <b>Noradrenaline or Levophed</b> | It is a catecholamine used to restore the blood pressure in acute hypotension, when MAP < 60mmHg. It causes peripheral vasoconstriction.  |
| <b>PaCO2</b>                     | Partial Pressure of Carbon Dioxide in the arterial blood. It is critical in regulating breathing levels and maintaining body pH. Range: 4.7-6.0kPa or 35-45mmHg. High PaCO2 (respiratory acidosis) indicates hypoventilation and low PaCO2 (respiratory alkalosis) indicates hyperventilation. PaCO2 levels can alter in compensation to normalize pH.      |
| <b>PaO2</b>                      | Partial Pressure of Oxygen in the plasma phase of arterial blood. It refers to the oxygen molecules that are not bound to haemoglobin. Range: 9.3-13.3kPa or 80-100mmHg. Low PaO2 indicates that the patient is not respiring enough oxygen and is hypoxemic.   |
| <b>PAV</b>                       | Proportionate Assist Ventilation is a form of synchronized partial ventilatory support in which the ventilator generates pressure in proportion to the patient's effort.  |
| <b>PSV</b>                       | Pressure Support Ventilation in which the patient triggers the ventilator and a pressure-limited breath is delivered.   |
| <b>Peak Pressure</b>             | Peak airway pressure is the pressure measured by the ventilator in the major airways and it strongly reflects airway resistance.  |
| <b>PEEP</b>                      | Positive End Expiratory Pressure is the pressure in the alveoli at the end of expiration. It is the same as the CPAP and is used interchangeably.   |
| <b>pH</b>                        | pH is the negative log of the concentration of hydrogen in the blood ( $\text{pH} = -\log[\text{H}^+]$ ). It is a measure of the acidity and basicity of the blood (acid-base balance). High $\text{H}^+$ or low pH indicates acidosis, and low $\text{H}^+$ or high pH indicates alkalosis. Range for pH: 7.35-7.45. Range for $\text{H}^+$ : 35-45mmol/l. |
| <b>PMV</b>                       | Passy Muir Valve is a valve attached to the tracheostomy tube and allows the patient to speak.  |
| <b>Propofol</b>                  | It is a sedative drug used to induct general anaesthesia. The brand name is Diprivan.   |
| <b>PS</b>                        | Pressure Support is the pressure applied in the ventilator in inspiration in order to reduce the workload of  |

|                     |   |
|---------------------|---|
|                     | breathing.  |
| <b>Remifentanil</b> | It is a short acting synthetic opioid drug used for anaesthesia. It can cause decrease in heart rate and blood pressure, the respiratory rate and the tidal volume. Brand name is Ultiva. |
| <b>SIMV</b>         | Synchronized Intermittent Mandatory Ventilation is a conventional model of ventilation in which the set mandatory breaths are triggered by the patient.                                   |
| <b>SpO2</b>         | Saturation of oxygen in the blood and is expressed as a percentage. It refers to the oxygen molecules that are bound to haemoglobin. It is calculated with Pulse oximetry.                |
| <b>T-piece</b>      | It is a method used for weaning. The patient is disconnected from the ventilator and a T-piece tube is connected to the endotracheal tube and the oxygen supply.                          |
| <b>Ve</b>           | Minute Volume is the total volume of air inserted in the alveoli per minute.  |
| <b>Vt or Tv</b>     | Tidal Volume is the amount (or the volume) of air breathed in and out during normal respiration. It is measured in ml. Normally it is 500ml.  |

## **APPENDIX 4.1 PARTICIPANT INFORMATION SHEET FOR THE OBSERVATION PERIOD**

### **‘CRITICAL CARE NURSES’ DECISION-MAKING DURING WEANING FROM MECHANICAL VENTILATION’**

#### **WOULD YOU LIKE TO CONTRIBUTE TO THE IMPROVEMENT OF NURSES’ DECISION-MAKING IN INTENSIVE CARE?**

**If yes, you are invited to participate to a study that aims** to explore nurses' decision-making during the process of weaning mechanically ventilated patients so as to identify ways to increase their input and role in team working in critical care.

An area of critical care that demands nurses' effective decision-making and requires further investigation is the area of mechanical ventilation and in particular the process of weaning the patient off the artificial breathing. Clinical decision-making by nurses is very important because they are the clinicians who spend most of the time at the bedside and are aware of the patient's condition. Nevertheless, little is known about their input of knowledge in decisions made during the weaning process and how the interaction with other clinicians affects their decisions. Having this knowledge we could introduce methods to enhance nurses' role in team work and collaborative decision-making with respect to improve the weaning process of ventilated patients and their outcome.

As a critical care staff nurse, who believes that nurse-led weaning has a positive impact on the length of time of ventilation and an improved patient outcome, I will conduct this study for the purpose of my PhD. The title of the study is:

*Decision-making processes of weaning from mechanical ventilation. A comparative ethnographic insight into the dynamics of the decision environment.*

It is a qualitative ethnographic study which involves an international comparison of nurses' decision-making in Intensive Care Units. The settings compared will be one ICU in Scotland and one ICU in a hospital in Greece. The study will take place in this unit, for a period of 5 to 6 months. It is divided in two phases.



During the first phase, specific patient cases requiring long-term weaning will be identified. Nurse will be observed during the provision of care of the identified patient for 2 to 4 hours. A reflective conversation with the nurse will follow at the end of the shift.

The second phase of the study will involve follow-up interviews with the nurses, the doctors and the physiotherapists, in which you will be encouraged to participate. I will conduct the interviews in your working place. I will arrange with the charge nurse the appropriate place and time for the interview so that the patient's care will not be interrupted.

You are invited to take part in this study as a critical care nurse or a doctor or a physiotherapist caring for mechanically ventilated patients. Please read the relevant section that concerns your role in this study.

**If you are a nurse** you will be encouraged to participate during the observation of clinical practice while looking after the identified weaning patient. I will take notes throughout the observation and chat with you about the patient's progress. At the end of your shift, or when it is convenient for you, I will ask you to reflect on your thoughts and actions while managing the patient's weaning process. This interview will take approximately 30 minutes, will be recorded with a digital recorder and a microphone will be attached to your shirt. The recording will facilitate the accurate collection and analysis of the data.

During the second phase of the study, you will be encouraged to participate in a complementary interview about your perceptions on weaning practices and teamwork in your ward. This interview will take approximately 30 minutes and will be recorded.

**Taking part in the study is entirely voluntary.** You are free to withdraw at any time, without giving a reason. If you believe that your time in providing patient care is affected or that the patient you are looking after is disturbed, you are free to stop the process of data collection.

**If you are a doctor** you will be encouraged to take part at the second phase of the study in a complementary interview about your perceptions on weaning practices and teamwork in your ward. This interview will take approximately 30 minutes and will be recorded.

**Taking part in the study is entirely voluntary.** You are free to withdraw at any time, without giving a reason. If you believe that your time in providing patient care is affected or

that the patient you are looking after is disturbed, you are free to stop the process of data collection.

**If you are a physiotherapist** you will be encouraged to take part at the second phase of the study in a complementary interview about your perceptions on weaning practices and teamwork in your ward. This interview will take approximately 30 minutes and will be recorded.

**Taking part in the study is entirely voluntary.** You are free to withdraw at any time, without giving a reason. If you believe that your time in providing patient care is affected or that the patient you are looking after is disturbed, you are free to stop the process of data collection.

**What is required from you:** Just 30 minutes of your valuable time will be required, if you agree to participate in this highly informative study on weaning practices in the real setting.

You will be asked to sign a consent form that is attached to the information sheet. In the package, you will also find a questionnaire about your demographic characteristics. This will be used just to help me identify those nurses who would like to participate. You will be asked to fill in this questionnaire and enclose it in the envelope provided. A box will be kept in the ward, where you can put the returned envelopes. All information will be kept **confidential**, you will be allocated a code number and only I will have access to that.

The charge nurses are aware about the study and are supportive. If you have any problem with the study or you need to get advice from an Independent Advisor, you are encouraged to contact Professor Rosemary Mander. Her contact details are shown below.

I am the Principal Investigator for this study and I have already secured ethical approval from the NHS Ethics Committee, the University and the Research and Development department. In the information sheet are also included my contact details if you wish to discuss anything about the study. I would be glad to answer any questions in relation to the study and you can contact me at any time.

Your contribution is really valuable and I do appreciate your effort and time. I really look forward to the results of this study! I hope that you will enjoy it as much as I will.

Thank you very much for your help!

Kalliopi Kydonaki

PhD student,

School of Health in Social Science, University of Edinburgh

**Chief Investigator contact details:**

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EH8 9AG

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**Independent Advisor contact detail:**

Professor Rosemary Mander

Nursing Studies

School of Health in Social Science

Medical School

Teviot Place

EH8 9AG

Edinburgh

email: [R.Mander@ed.ac.uk](mailto:R.Mander@ed.ac.uk)

## APPENDIX 4.2 CONSENT FORM FOR THE FOLLOW-UP INTERVIEWS

Participant identification number (To be filled in by the Principal Investigator)

.....

### CONSENT FORM

Title of the project: Decision-making processes of weaning from mechanical ventilation. A comparative ethnographic insight into the dynamics of the decision environment.

Name of the researcher: Kalliopi Kydonaki

1. I confirm that I have read and understood the information sheet date..... for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily. ☐

2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason. ☐

3. I understand that all information given will be kept confidential and that no personal details will be revealed to anyone but the Principal Investigator. ☐

4. I understand what is requested from me to do. ☐

5. I agree to take part in the above study. ☐ †

.....

Name of the participant

.....

Date

.....

Signature

## APPENDIX 4.3 DEMOGRAPHIC CHARACTERISTICS QUESTIONNAIRE

(Please fill in capital letters)

Participant identification number (To be filled in by the Principal Investigator)

.....

**1. Name:**.....

**2. Sex:** (Please tick as appropriate)

Female ☐

Male ☐

**3. Age:** (Please tick as appropriate)

<20 years old ☐

21 – 30 years old ☐

31 – 40 years old ☐

41 – 50 years old ☐

51 – 60 years old ☐

>61 years old ☐

**4. Academic Qualifications:** (Please tick as appropriate)

Nursing Certificate ☐

Nursing Diploma ☐

BSc in Nursing/ Degree ☐

PGCE/ PGDipEd ☐

MSc/MA in Nursing ☐

PhD in Nursing ☐

Other:.....

**5. Professional Qualifications:** (Please tick as appropriate)

- ENB 100 or equivalent ☐
- Level 2 Critical Care Certificate ☐
- Level 3 Critical Care Certificate ☐
- BSc in Critical Care ☐
- MSc in Critical Care ☐
- Other:.....

**6. Experience in Intensive Care:** (Please tick as appropriate)

- <5 years ☐
- 6 – 10 years ☐
- 11 – 15 years ☐
- 16 – 20 years ☐
- 21 – 25 years ☐
- 26 – 30 years ☐
- > 31 years ☐

**7. How many years have you worked in this ICU as a staff nurse?**

(Please tick as appropriate)

- <5 years ☐
- 6 – 10 years ☐
- 11 – 15 years ☐
- 16 – 20 years ☐
- 21 – 25 years ☐
- 26 – 30 years ☐
- > 31 years ☐

Thank you for your cooperation!

## **APPENDIX 4.4A**

### **ETHICS COMMITTEE AND R&D APPROVAL FOR SCOTLAND**

**APPENDIX 4.4B**

**LETTER FOR THE ETHICS COMMITTEE APPROVAL  
FOR GREECE**



Προς το

**Επιστημονικό Συμβούλιο του Περιφερειακού Πανεπιστημιακού Γενικού  
Νοσοκομείου Ηρακλείου**

**Εισήγηση για έγκριση διδακτορικής μελέτης**

**Θέμα: Μία διακρατική εθνογραφική μελέτη μεταξύ Βρετανίας και Ελλάδας για την λήψη αποφάσεων κατά τη διαδικασία αποσύνδεσης μηχανικά αεριζόμενου ασθενούς από τον αναπνευστήρα.**

Η παρούσα εισήγηση απευθύνεται στην επιστημονική ομάδα του Περιφερειακού Πανεπιστημιακού Γενικού Νοσοκομείου Ηρακλείου και στην ομάδα βιο-ηθικής, προκειμένου να εξεταστεί το πρωτόκολλο της παρούσας μελέτης που θα πραγματοποιηθεί από τη διδακτορική φοιτήτρια της Νοσηλευτικής του Πανεπιστημίου του Εδιμβούργου, Καλλιόπη Κυδωνάκη, στη Μονάδα Εντατικής Θεραπείας του Νοσοκομείου σας.

Ο γενικός σκοπός της μελέτης είναι η διερεύνηση της συμπεριφοράς των νοσηλευτών, της συμβολής και των αντιλήψεών τους, σχετικά με τη λήψη αποφάσεων για τη διακοπή της μηχανικής υποστήριξης της αναπνοής και ο προσδιορισμός τρόπων για τη βελτίωση της συμβολής και του ρόλου της ομαδικής εργασίας στην εντατική θεραπεία.

Πρόκειται για μια συγκριτική εθνογραφική μελέτη που διερευνά τις ενέργειες και το ρόλο των αποφάσεων των νοσηλευτών κατά τη διαδικασία αποσώληνωσης των μηχανικά αεριζόμενων ασθενών. Ο πυρήνας της ποιοτικής αυτής έρευνας είναι η ανθρώπινη συμπεριφορά και η κατανόηση των εννοιών και των σκοπών που προσδίδουν τα άτομα στις δραστηριότητές τους.

Οι στόχοι της μελέτης θα τεθούν με τη διεξαγωγή εθνογραφικής συγκριτικής μελέτης μεταξύ δύο ευρωπαϊκών χωρών με διαφορετικό πολιτισμό, αλλά με Εθνικό Σύστημα Υγείας. Θα γίνει σύγκριση μεταξύ δύο Μονάδων Εντατικής Θεραπείας, η μία στη Σκωτία και η άλλη στην Ελλάδα, στις οποίες νοσηλεύονται ασθενείς που χρήζουν μηχανικού αερισμού. Με τη σύγκριση αυτή θα υπάρξει καλύτερη κατανόηση της λήψης αποφάσεων από τους νοσηλευτές στο περιβάλλον της εντατικής θεραπείας.

Συνοπτικά, η κύρια μέθοδος συλλογής δεδομένων που θα χρησιμοποιηθεί, είναι η παρατήρηση των νοσηλευτών κατά τη διάρκεια παροχής φροντίδας στους μηχανικά αεριζόμενους ασθενείς που θα επιλεγούν για την έρευνα. Η μελέτη θα επικεντρωθεί στην μείωση της μηχανικής αναπνευστικής υποστήριξης ασθενών που εισήχθησαν στη ΜΕΘ με πνευμονία ή επιδείνωση Χρόνιας Αναπνευστικής Ανεπάρκειας. Οι νοσηλευτές που έχουν αναλάβει τη φροντίδα των συγκεκριμένων ασθενών και που επιθυμούν να συμμετάσχουν στην έρευνα, θα παρατηρούνται εν ώρα εργασίας για διάρκεια 2 ωρών στο τέλος της οποίας θα τους ζητηθεί να μιλήσουν για περίπου 15-20 λεπτά για τις αποφάσεις που έλαβαν τη συγκεκριμένη ημέρα και για τον συγκεκριμένο ασθενή. Ένα ψηφιακό μαγνητόφωνο θα

χρησιμοποιηθεί για την καταγραφή της δεκαπεντάλεπτης συνομιλίας του νοσηλευτή με την ερευνήτρια για τον ασθενή.

Η περίοδος παρατήρησης των νοσηλευτών θα διαρκέσει περίπου 4 μήνες. Στη συνέχεια θα ακολουθήσουν σε βάθος συνεντεύξεις με το προσωπικό της μονάδας υπό μορφή ομάδων εργασίας. Η ερευνήτρια θα διανείμει επίσης ένα ανώνυμο ερωτηματολόγιο, το Έντυπο Καταγραφής Κλίματος Ομάδας, προκειμένου να διερευνηθούν οι απόψεις των ιατρών και των νοσηλευτών σχετικά με το επίπεδο και την ποιότητα της ομαδικής εργασίας της μονάδας.

Η συμμετοχή των νοσηλευτών στη μελέτη αυτή είναι καθαρά εθελοντική. Οι νοσηλευτές που θα επιθυμήσουν να συμμετάσχουν θα πρέπει να δώσουν γραπτή συγκατάθεση. Όλα τα στοιχεία που θα συγκεντρωθούν κατά την περίοδο συλλογής δεδομένων θα διατηρηθούν εμπιστευτικά και ανώνυμα. Μόνο η ερευνήτρια θα έχει πρόσβαση σε αυτά. Δεν υπάρχει κίνδυνος για τη φροντίδα των ασθενών διότι δεν θα συμμετέχουν ενεργά στην έρευνα. Ωστόσο, θα χρειαστεί πρόσβαση στον ιατρικό φάκελο των ασθενών που θα επιλεγούν για την πραγματοποίηση της έρευνας.

Η ερευνήτρια, Καλλιόπη Κυδωνάκη, δεν έχει καμία οικονομική απαίτηση από το νοσοκομείο για την πραγματοποίηση της μελέτης αυτής.

Εδιμβούργο, 17/01/2008

Με εκτίμηση

Η ερευνήτρια

Καλλιόπη Κυδωνάκη

## **APPENDIX 4.5 INTERVIEW GUIDE FOR THE FOLLOW-UP INTERVIEWS WITH THE NURSES, THE DOCTORS AND THE PHYSIOTHERAPISTS**

How do you wean a long-term ventilated patient in this unit?

Is there a specific weaning protocol that you follow?

Do you make any decisions when you manage the patient's breathing? What are they?

Are you involved in adjusting the settings of the ventilator?

Do you think that you influence the care of the patient who is weaning and how?

Which criteria or factors influence your decisions during the weaning process?

What is the role of the nurse during the weaning process?

What is your opinion about teamwork in this unit? And how does that affect the decisions made?

What is your opinion about the communication between the members of staff?

# **APPENDIX 4.6 DEMOGRAPHIC CHARACTERISTICS OF DOCTOR PARTICIPANTS**

| <b>DEMOGRAPHIC CHARACTERISTICS OF DOCTOR PARTICIPANTS</b> |               | <b>SCOTLAND<br/>N=3</b> | <b>GREECE<br/>N=6</b> |
|---|---------------|-------------------------|-----------------------|
| Gender  | M             | 2                       | 1                     |
|   | F             | 1                       | 4                     |
| Designation   | Junior doctor | 1                       | 1                     |
|   | Registrar     | 1                       | 4                     |
|   | Consultant    | 1                       | 1                     |
| Speciality  | Anaesthetics  | 1                       | 0                     |
|   | Intensivist   | 2                       | 6                     |

## APPENDIX 4.7 DECISION EPISODES TOOL

### Decision Episodes Tool

**Patient code:**

**Date:**

1. Were ventilator settings changed for this 24h period? Yes/No

2. How many times were ventilator settings changed in this 24h period?

3. What changes of the ventilator settings happened in this 24h period?

|                    | Event 1 | Event 2 | Event 3 | Event 4 | Event 5 |
|--------------------|---------|---------|---------|---------|---------|
| Adjustment of mode |         |         |         |         |         |
| Adjustment of PS   |         |         |         |         |         |
| Adjustment of PEEP |         |         |         |         |         |
| Adjustment of FiO2 |         |         |         |         |         |

4. Who made the changes of the ventilator?

|                      | Event 1 | Event 2 | Event 3 | Event 4 | Event 5 |
|----------------------|---------|---------|---------|---------|---------|
| Nurse                |         |         |         |         |         |
| Doctor               |         |         |         |         |         |
| Collaborate          |         |         |         |         |         |
| Doctor directs nurse |         |         |         |         |         |

5. Why were ventilator settings changed?

| Indications | Event 1 | Event 2 | Event 3 | Event 4 | Event 5 |
|-------------|---------|---------|---------|---------|---------|
|             |         |         |         |         |         |

|  |  |  |  |  |  |
|--|--|--|--|--|--|
| <b>Blood gas results</b>               |  |  |  |  |  |
| <b>Change in saturation</b>            |  |  |  |  |  |
| <b>Increased work of breathing</b>     |  |  |  |  |  |
| <b>Change in inspiratory pressures</b> |  |  |  |  |  |
| <b>Weaning purposes</b>                |  |  |  |  |  |
| <b>Other</b>                           |  |  |  |  |  |

6. Who initiated the weaning?

- a. Nurse ☐
- b. Doctor ☐
- c. Collaboratively ☐
- d. Doctor directs nurse ☐

7. Who initiated the decision to extubate the patient?

- a. Nurse ☐
- b. Doctor ☐
- c. Collaboratively ☐
- d. Doctor directs nurse ☐

8. Who extubated the patient?

- a. Nurse ☐
- b. Doctor ☐
- c. Collaboratively ☐
- d. Doctor directs nurse ☐

9. What other decisions did nurses make during weaning?

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10. Was the sedation reduced or stopped today?

Yes/No

11. Who made the decision to reduce or stop the sedation?

- a. Nurse ☐
- b. Doctor ☐
- c. Collaboratively ☐
- d. Doctor directs nurse ☐

12. Who accomplished the decision to reduce or stop the sedation?

- a. Nurse ☐
- b. Doctor ☐
- c. Collaboratively ☐

13. Was the sedation increased again?

Yes/No

14. Who made the decision to increase the sedation?

- a. Nurse ☐
- b. Doctor ☐
- c. Collaboratively ☐
- d. Doctor directs nurse ☐

15. Who accomplished the decision to increase the sedation?

- a. Nurse ☐
- b. Doctor ☐
- c. Collaboratively ☐

**APPENDIX 4.8 ADJUSTMENT OF THE VENTILATOR TOOL (AVT)**

**Patient code:**

| DAY 1   |      |    |      |         |      |  |
|---------|------|----|------|---------|------|--|
| Event 1 |      |    |      | Event 2 |      |  |
| MODE    | FIO2 | PS | PEEP | MODE    | FIO2 |  |
|         |      |    |      |         |      |  |
|         |      |    |      |         |      |  |
| DAY 2   |      |    |      |         |      |  |
| Event 1 |      |    |      | Event 2 |      |  |
| MODE    | FIO2 | PS | PEEP | MODE    | FIO2 |  |
|         |      |    |      |         |      |  |
|         |      |    |      |         |      |  |
| DAY 3   |      |    |      |         |      |  |
| Event 1 |      |    |      | Event 2 |      |  |
| MODE    | FIO2 | PS | PEEP | MODE    | FIO2 |  |
|         |      |    |      |         |      |  |
|         |      |    |      |         |      |  |



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|----|--|------|--|------|---------|----|------|---------|--|
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|    |  |      |  |      | Event 3 |    |      | Event 4 |  |
| PS |  | PEEP |  | MODE | FIO2    | PS | PEEP | MODE    |  |
|    |  |      |  |      |         |    |      |         |  |
|    |  |      |  |      |         |    |      |         |  |
|    |  |      |  |      | Event 3 |    |      | Event 4 |  |
| PS |  | PEEP |  | MODE | FIO2    | PS | PEEP | MODE    |  |
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|    |  |      |  |      | Event 3 |    |      | Event 4 |  |
| PS |  | PEEP |  | MODE | FIO2    | PS | PEEP | MODE    |  |
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|    |  |      |  |      | Event 3 |    |      | Event 4 |  |
| PS |  | PEEP |  | MODE | FIO2    | PS | PEEP | MODE    |  |
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| PS |  | PEEP |  | MODE | FIO2    | PS | PEEP | MODE    |  |
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|    |  |      |  |      | Event 3 |    |      | Event 4 |  |
| PS |  | PEEP |  | MODE | FIO2    | PS | PEEP | MODE    |  |
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|    |  |      |  |      | Event 3 |    |      | Event 4 |  |
| PS |  | PEEP |  | MODE | FIO2    | PS | PEEP | MODE    |  |
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|    |  |      |  |      | Event 3 |    |      | Event 4 |  |
| PS |  | PEEP |  | MODE | FIO2    | PS | PEEP | MODE    |  |
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| PS |  | PEEP |  | MODE | FIO2    | PS | PEEP | MODE    |  |
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| PS |  | PEEP |  | MODE | FIO2    | PS | PEEP | MODE    |  |
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| PS |  | PEEP |  | MODE | FIO2    | PS | PEEP | MODE    |  |
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| PS |  | PEEP |  | MODE | FIO2    | PS | PEEP | MODE    |  |
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|    |  |      |  |      | Event 3 |    |      | Event 4 |  |
| PS |  | PEEP |  | MODE | FIO2    | PS | PEEP | MODE    |  |
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|    |  |      |  |      | Event 3 |    |      | Event 4 |  |
| PS |  | PEEP |  | MODE | FIO2    | PS | PEEP | MODE    |  |
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|    |  |      |  |      | Event 3 |    |      | Event 4 |  |
| PS |  | PEEP |  | MODE | FIO2    | PS | PEEP | MODE    |  |
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|    |  |      |  |      | Event 3 |    |      | Event 4 |  |
| PS |  | PEEP |  | MODE | FIO2    | PS | PEEP | MODE    |  |
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|    |  |      |  |      | Event 3 |    |      | Event 4 |  |
| PS |  | PEEP |  | MODE | FIO2    | PS | PEEP | MODE    |  |
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|    |  |      |  |      | Event 3 |    |      | Event 4 |  |
| PS |  | PEEP |  | MODE | FIO2    | PS | PEEP | MODE    |  |
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|    |  |      |  |      | Event 3 |    |      | Event 4 |  |
| PS |  | PEEP |  | MODE | FIO2    | PS | PEEP | MODE    |  |
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|    |  |      |  |      | Event 3 |    |      | Event 4 |  |
| PS |  | PEEP |  | MODE | FIO2    | PS | PEEP | MODE    |  |
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|    |  |      |  |      | Event 3 |    |      | Event 4 |  |
| PS |  | PEEP |  | MODE | FIO2    | PS | PEEP | MODE    |  |
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|    |  |      |  |      | Event 3 |    |      | Event 4 |  |
| PS |  | PEEP |  | MODE | FIO2    | PS | PEEP | MODE    |  |
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|    |  |      |  |      | Event 3 |    |      | Event 4 |  |
| PS |  | PEEP |  | MODE | FIO2    | PS | PEEP | MODE    |  |
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|    |  |      |  |      | Event 3 |    |      | Event 4 |  |
| PS |  | PEEP |  | MODE | FIO2    | PS | PEEP | MODE    |  |
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|    |  |      |  |      | Event 3 |    |      | Event 4 |  |
| PS |  | PEEP |  | MODE | FIO2    | PS | PEEP | MODE    |  |
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|    |  |      |  |      | Event 3 |    |      | Event 4 |  |
| PS |  | PEEP |  | MODE | FIO2    | PS | PEEP | MODE    |  |
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|    |  |      |  |      | Event 3 |    |      | Event 4 |  |
| PS |  | PEEP |  | MODE | FIO2    | PS | PEEP | MODE    |  |
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|    |  |      |  |      | Event 3 |    |      | Event 4 |  |
| PS |  | PEEP |  | MODE | FIO2    | PS | PEEP | MODE    |  |
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|    |  |      |  |      | Event 3 |    |      | Event 4 |  |
| PS |  | PEEP |  | MODE | FIO2    | PS | PEEP | MODE    |  |
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|    |  |      |  |      | Event 3 |    |      | Event 4 |  |
| PS |  | PEEP |  | MODE | FIO2    | PS | PEEP | MODE    |  |
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|    |  |      |  |      | Event 3 |    |      | Event 4 |  |
| PS |  | PEEP |  | MODE | FIO2    | PS | PEEP | MODE    |  |
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|    |  |      |  |      | Event 3 |    |      | Event 4 |  |
| PS |  | PEEP |  | MODE | FIO2    | PS | PEEP | MODE    |  |
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|    |  |      |  |      | Event 3 |    |      | Event 4 |  |
| PS |  | PEEP |  | MODE | FIO2    | PS | PEEP | MODE    |  |
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|    |  |      |  |      | Event 3 |    |      | Event 4 |  |
| PS |  | PEEP |  | MODE | FIO2    | PS | PEEP | MODE    |  |
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|    |  |      |  |      | Event 3 |    |      | Event 4 |  |
| PS |  | PEEP |  | MODE | FIO2    | PS | PEEP | MODE    |  |
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|    |  |      |  |      | Event 3 |    |      | Event 4 |  |
| PS |  | PEEP |  | MODE | FIO2    | PS | PEEP | MODE    |  |
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|    |  |      |  |      | Event 3 |    |      | Event 4 |  |
| PS |  | PEEP |  | MODE | FIO2    | PS | PEEP | MODE    |  |
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|    |  |      |  |      | Event 3 |    |      | Event 4 |  |
| PS |  | PEEP |  | MODE | FIO2    | PS | PEEP | MODE    |  |
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|    |  |      |  |      | Event 3 |    |      | Event 4 |  |
| PS |  | PEEP |  | MODE | FIO2    | PS | PEEP | MODE    |  |
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|    |  |      |  |      | Event 3 |    |      | Event 4 |  |
| PS |  | PEEP |  | MODE | FIO2    | PS | PEEP | MODE    |  |
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|    |  |      |  |      | Event 3 |    |      | Event 4 |  |
| PS |  | PEEP |  | MODE | FIO2    | PS | PEEP | MODE    |  |
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|    |  |      |  |      | Event 3 |    |      | Event 4 |  |
| PS |  | PEEP |  | MODE | FIO2    | PS | PEEP | MODE    |  |
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|    |  |      |  |      | Event 3 |    |      | Event 4 |  |
| PS |  | PEEP |  | MODE | FIO2    | PS | PEEP | MODE    |  |
|    |  |      |  |      |         |    |      |         |  |

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|------|----|------|------|------|---------|------|--|--|--|--|--|--|
|      |    |      |      |      |         |      |  |  |  |  |  |  |
|      |    |      |      |      | Event 5 |      |  |  |  |  |  |  |
|      |    |      |      |      |         |      |  |  |  |  |  |  |
| FIO2 | PS | PEEP | MODE | FIO2 | PS      | PEEP |  |  |  |  |  |  |
|      |    |      |      |      |         |      |  |  |  |  |  |  |
|      |    |      |      |      |         |      |  |  |  |  |  |  |
|      |    |      |      |      | Event 5 |      |  |  |  |  |  |  |
| FIO2 | PS | PEEP | MODE | FIO2 | PS      | PEEP |  |  |  |  |  |  |
|      |    |      |      |      |         |      |  |  |  |  |  |  |

## APPENDIX 4.9 THEMES IDENTIFIED FROM THEMATIC ANALYSIS OF DATA

| Core themes                    | Nodes                           | Codes                         | Sub-codes                      |
|--------------------------------|---------------------------------|-------------------------------|--------------------------------|
| Practice environment           |                                 |                               |                                |
|                                | Authority                       | Power                         |                                |
|                                |                                 | Legal right                   |                                |
|                                | Communication                   | Documentation of weaning plan |                                |
|                                |                                 | Verbal communication          |                                |
|                                | Motivation and job satisfaction |                               |                                |
|                                | Accountability                  |                               |                                |
|                                | Organisational structure        | Shift pattern                 |                                |
|                                |                                 | Nurse allocation              |                                |
|                                |                                 | Ward round patterns           |                                |
|                                |                                 | Competitive climate           |                                |
|                                | Personality                     |                               |                                |
|                                | Support                         | Education                     |                                |
|                                |                                 | Encourage decision-making     |                                |
|                                |                                 | Increase staff levels         |                                |
|                                | Experience                      |                               |                                |
| Interactions & Teamwork        |                                 |                               |                                |
|                                | Context of interaction          |                               |                                |
|                                |                                 | Opportunity to raise concerns |                                |
|                                |                                 | Pass information              |                                |
|                                |                                 | Seek for advice               |                                |
|                                | Outcome of interaction          |                               |                                |
|                                |                                 | Agreement                     |                                |
|                                |                                 | Disagreement                  |                                |
|                                |                                 |                               | Follow the doctor's order      |
| Practising the weaning journey |                                 |                               |                                |
|                                | Assessment of the patient       |                               |                                |
|                                | Accuracy                        |                               |                                |
|                                | Clinical tests                  |                               |                                |
|                                | Weanable patient                | Knowledge of the patient      | Medical history of the patient |
|                                |                                 |                               | Looked after the patient       |

|  |                    |                                   |  |
|--|--------------------|-----------------------------------|--|
|  |                    |                                   | previously   |
|  |                    | Signs of infection                | Increased temperature  |
|  |                    |                                   | Increased amount of secretions   |
|  |                    | Physiological attributes          | Blood pressure<br>Heart rate<br>Electrocardiogram<br>Fluid balance<br>Use of inotropes<br>Peripheral oedema<br>Distended abdomen   |
|  |                    | Level of consciousness            | GCS<br>RASS score<br>Anxiety, agitation, hyperactivity<br>Be flat<br>Spontaneous breaths   |
|  |                    | Gas exchange                      | Level of PaO <sub>2</sub> , PaCO <sub>2</sub> ,  |
|  |                    | Work of breathing                 | EtCO <sub>2</sub> , SpO <sub>2</sub><br>Respiratory rate<br>Tidal volumes<br>Accessory muscles<br>Quality and amount of secretions<br>Breathing sounds<br>Breathing pattern<br>Bronchospasm, coughing<br>Pulmonary oedema<br>Atelectasis |
|  | Maintain a balance |                                   |  |
|  |                    | Agitation                         |  |
|  |                    | Pain                              |  |
|  |                    | Discomfort                        |  |
|  |                    | Sedation hold                     |  |
|  |                    |                                   |  |
|  | Wean as able       |                                   |  |
|  |                    | Adjustment of ventilatory support | Weaning patterns   |
|  |                    |                                   | Aggressive   Conservative  |
|  |                    | Modes of ventilation              | Trial and error  |
|  |                    | Parameter thresholds              | Gut feeling  |
|  |                    | Extubation                        |  |
|  |                    | Spontaneous                       |  |

|  |                     |  |  |
|--|---------------------|--|--|
|  |                     | breathing trial                        |  |
|  |                     | Tracheostomy formation                 |  |
|  | Use of protocol     |  |  |
|  | Physiotherapy       |  |  |
|  |                     | Suctioning                             |  |
|  |                     | Manual ventilation                     |  |
|  |                     | Mobilisation                           |  |
|  | Psychological input |  |  |
|  |                     | Inform the patient about interventions |  |
|  |                     | Orientate in place and time            |  |

## APPENDIX 4.10 INTERNAL RELIABILITY

| Nodes                           | Codes                         | Sub-codes                 | Researcher | Expert | Dual |
|---------------------------------|-------------------------------|---------------------------|------------|--------|------|
| Authority                       |                               |                           | +          | +      | +    |
|                                 | Power                         |                           | +          | +      | +    |
|                                 | Legal right                   |                           | +          | +      | +    |
| Communication                   |                               |                           | +          | +      | +    |
|                                 | Documentation of weaning plan |                           | +          | +      | +    |
|                                 | Verbal communication          |                           | +          | +      | +    |
| Motivation and job satisfaction |                               |                           | -          | +      | +    |
| Accountability                  |                               |                           | +          | +      | +    |
| Organisational structure        |                               |                           | +          | +      | +    |
|                                 | Shift pattern                 |                           | +          | +      | +    |
|                                 | Nurse allocation              |                           | +          | +      | +    |
|                                 | Ward round patterns           |                           | +          | +      | +    |
|                                 | Competitive climate           |                           | +          | +      | +    |
| Personality                     |                               |                           | +          | +      | +    |
| Support                         |                               |                           | +          | +      | +    |
|                                 | Education                     |                           | +          | +      | +    |
|                                 | Encourage decision-making     |                           | +          | +      | +    |
|                                 | Increase staff levels         |                           | +          | +      | +    |
| Context of interaction          |                               |                           | +          | -      | +    |
|                                 | Opportunity to raise concerns |                           | +          | +      | +    |
|                                 | Pass information              |                           | +          | +      | +    |
|                                 | Seek for advice               |                           | +          | +      | +    |
| Outcome of interaction          |                               |                           | +          | +      | +    |
|                                 | Agreement                     |                           | +          | +      | +    |
|                                 | Disagreement                  |                           | -          | -      | +    |
|                                 |                               | Follow the doctor's order | -          | +      | +    |
| Assessment of the patient       |                               |                           | +          | +      | +    |
| Accuracy                        |                               |                           | +          | -      | +    |
| Clinical tests                  |                               |                           | +          | +      | +    |
|                                 | Knowledge of                  |                           | +          | +      | +    |

|                    |                          |  |   |   |   |
|--------------------|--------------------------|--|---|---|---|
|                    | the patient              |  |   |   |   |
|                    |                          | Medical history of the patient   | + | + | + |
|                    |                          | Looked after the patient previously  | + | + | + |
|                    | Signs of Infection       |  | + | + | + |
|                    |                          | Increased temperature  | + | + | + |
|                    |                          | Increased amount of secretions   | + | + | + |
|                    | Physiological attributes |  | + | + | + |
|                    |                          | Blood pressure   | + | + | + |
|                    |                          | Heart rate   | + | + | + |
|                    |                          | Electrocardiogram  | + | + | + |
|                    |                          | Use of inotropes   | + | + | + |
|                    |                          | Peripheral oedema  | + | + | + |
|                    |                          | Distended abdomen  | + | + | + |
|                    |                          | Fluid balance  | + | + | + |
|                    | Level of consciousness   |  | + | + | + |
|                    |                          | GCS  | + | + | + |
|                    |                          | RASS score   | + | + | + |
|                    |                          | Anxiety, agitation, hyperactivity  | + | + | + |
|                    |                          | Be flat  | + | + | + |
|                    |                          | Spontaneous breaths  | + | + | + |
|                    | Work of Breathing        |  | + | + | + |
|                    |                          | Gas exchange (level of PaO <sub>2</sub> , PaCO <sub>2</sub> , EtCO <sub>2</sub> , SpO <sub>2</sub> ) | + | + | + |
|                    |                          | Respiratory rate   | + | + | + |
|                    |                          | Tidal volumes  | + | + | + |
|                    |                          | Accessory muscles  | + | + | + |
|                    |                          | Quality and amount of secretions   | + | + | + |
|                    |                          | Breathing sounds   | + | + | + |
|                    |                          | Breathing pattern  | + | + | + |
|                    |                          | Bronchospasm coughing  | + | + | + |
|                    |                          | Pulmonary oedema   | + | + | + |
|                    |                          | Atelectasis  | + | + | + |
| Maintain a balance |                          |  | + | + | + |

|                     |  |                              |   |   |   |   |   |   |
|---------------------|--|------------------------------|---|---|---|---|---|---|
|                     | Agitation                              |                              | + |   | + |   | + |   |
|                     | Pain                                   |                              | + |   | + |   | + |   |
|                     | Discomfort                             |                              | + |   | + |   | + |   |
|                     | Sedation hold                          |                              | + |   | + |   | + |   |
| Wean as able        |  |                              | + |   | + |   | + |   |
|                     | Adjustment of ventilatory support      |                              | + |   | + |   | + |   |
|                     |  | Weaning patterns             | + |   | + |   | + |   |
|                     |  | Aggressive      Conservative | + | + | + | + | + | + |
|                     | Modes of ventilation                   |                              | + |   | + |   | + |   |
|                     | Parameter thresholds                   |                              | + |   | + |   | + |   |
|                     | Extubation                             |                              | - |   | - |   | + |   |
|                     | Spontaneous breathing trial            |                              | + |   | + |   | + |   |
|                     | Tracheostomy formation                 |                              | + |   | + |   | + |   |
|                     | Use of protocol                        |                              | + |   | + |   | + |   |
| Physiotherapy       |  |                              | + |   | + |   | + |   |
|                     | Suctioning                             |                              | + |   | + |   | + |   |
|                     | Manual ventilation                     |                              | + |   | + |   | + |   |
|                     | Mobilisation                           |                              | + |   | + |   | + |   |
| Psychological input |  |                              | + |   | + |   | + |   |
|                     | Inform the patient about interventions |                              | + |   | - |   | + |   |
|                     | Orientate in place and time            |                              | + |   | - |   | + |   |

83 items identified. Disagreement between researcher and expert in 9 items (10.84%)  
Agreement 100% after consensus



## **APPENDIX 4.11A EXAMPLE OF A REFLECTIVE INTERVIEW WITH A NURSE**

### **TRANSCRIPT FROM REFLECTIVE INTERVIEW WITH A NURSE**

5TH NOVEMBER 2007

Nurse: 'I think I'll have a little listen to his chest and see how it sounds now that I have put him on the T-piece. His saturation is more than satisfactory on 40% O<sub>2</sub>, same level of O<sub>2</sub> on the ventilator, RR of 28, the patient looks comfortable with his breathing, just a bit of suctioning, and he's got respectful cough with mucopurulent secretions...Em, the only concern is that the patient is quite hypotensive at the moment at 80 over 50...I think it's just a case of watching him at the moment, his BP has never been significantly higher. He's had MAP of approximately 70 on average, so I'll just watch him, observe him at the moment.

Jason, I'm just gonna have a listen to your breathing, just to see if your breathing feels ok. That's marvellous! Can you give me a big deep slow breath in Jason? And again...Nice slow deep breaths...Well done! What I want you to do Jason while sitting is to take nice slow deep breaths. While you are sitting on the chair that's the best position for your breathing, so we can try to expand those lungs. At the moment your breathing is quite shallow and fast. One of the reasons why we sit you out of the bed is to get you try to breathe a little bit better and it is more comfortable for you. And one way to do it is to try to get nice slow deep breaths, ok! Are you comfortable there? What is not comfortable? Your bottom? Your back? Is it your back that is not comfortable, Jason? Do you want me to sit you back a bit and see if that's gonna make you more comfortable.

Sometimes it gets a bit of time to get to find the best comfortable position to these chairs. Does that feel more comfortable? Yes...?

Ok, he seems comfortable enough. I think he is one of the most difficult patients to wean...Aren't they when they are agitated as well and not able to communicate terribly well with you, whether their breathing is good or what is bothering them, because you don't actually know what their level of consciousness is...I think it makes it a lot more difficult to guess where you are supposed to go with them when they are not cooperative with you...it's all a bit of a guess I think. So I don't think it's a fact and factors that you can follow, it's always a case of suck in and see, and see how the patient copes with it.

If that doesn't work, maybe we could try him on T-piece with the speaking valve, see if he can speak. Why don't we try to sit him up forward and put a pillow...right...if you sit forward Jason, and give us a little hand here...there we go! ...we can try that...how does that feel, does that feel more comfortable? Yes? Ok!

Jason do you want to try with a little speaking tube and see if you can manage to speak to us? Do you want to try that? What I might do just before we do that is to change that little dressing around your neck, and maybe Claire could give me a little hand.

Nurse: That's gonna be the words for today... 'don't pull that'

CK: We are just gonna change that nasty dressing, ok? His tummy looks distended, I said.

Nurse: Yes, that's what Alistair was saying, to talk to the GI doctors and see if they want to drain that. It's not annoying him, I don't know if it's better or worse, certainly it would splint things.

Nurse: Sometimes, that makes you cough a little bit, I do apologise. This might tickle...

CK: I think his rate is better now, isn't it?

Nurse: Yeeess, but I think his Tidal volumes are probably less, just looking at his chest expansion. But I think that sometimes you have to take the respiratory rate that the monitor gives you with a pinch of salt....Ok, Jason almost done, it's important to keep this tube clean. You are doing very well and if you keep up the good work, maybe we can take the tube out in a few days time, and get you talking and eating and do all the normal things. It is frustrating...Your mum will be coming to see you in a few hours Jason.

Nurse: I most often do that job on my own, but with Jason, I think it would be a potential disaster. (Referring to changing the tracheostomy dressing). That's you Jason. Right, what we will try to do is to put you on this different valve and see if we can get you to have a little talk. Ok, I'm just gonna let this air of this cuff down and sometimes it makes you cough a little bit. Jason, can you say one two tree for me.

The patient tries to say with a very slow, quiet voice.

CK: How does that feel Jason?

Nurse: How does your breathing feel Jason? Will you manage to talk to us? How does that feel with the voice in Jason? The voice is bit weak, isn't it? Does your breathing feel comfortable with that? What do you think?

Jason, do you know where you are? Can you tell me where you are? What building are we here? Do you know what city are we in? Are we in Glasgow? Are we in Newcastle? Where do you think we are? [It's difficult to hear him!] Jason, do you know we are in Edinburgh? You are in hospital in Edinburgh. Do you remember any of that? No. You are in hospital in Edinburgh in Intensive Care Unit, and you are here because your breathing has been bad, and you have been here for quite a few days now, but your breathing is getting better. But at the moment, you still need

some help with your breathing, which is the machine that you've got in your neck and it helps you breathe, and we can clear your chest.... Do you know this is a hospital? And Claire and I, we are nurses in Intensive Care unit and we are trying to get you better, and you are getting better. But it's not gonna be quick because your breathing is not very good and because you are so weak.

Well you seem comfortable with that, but I don't think you have much of a voice there, but perhaps it's gonna become a bit stronger. In the next few days you will become stronger, but what we need you to do is basically to chill out and try to help us, so that we can help you. If you want to get out of hospital, then what we need you to do is to cooperate and just try to make life easier for yourself, ok? Now, are you comfortable there? Have you got any aches and pains anywhere? Your bum? Ok, we will leave your voice for a little bit, ok, and see if it's going to get a bit stronger.

Nurse: I'm not convinced... very weak voice. So, as far as assessment with his breathing, if I'm still on the microphone, he was changed from T-piece ventilation to T-piece with the passive valve with the cuff down, and he's got a very weak cough, sorry... he's got a very strong cough but very weak voice. He managed to cough up 2-3 cough cups of mucous-purulent secretions, which would have probably been more difficult to get up using the suction technique. As far as his observation, he remains static with a heart rate of about 90 sinus, saturation of about 96-98% and respiratory rate of about 25-28 which is not significantly different. The patient looks comfortable with his breathing.

Nurse: We're going to give him a bit of background valium, which I think might help his agitation, but I think I'm not giving it until he is back in his bed, just in view of his slightly low blood pressure. He's not unmanageable at the moment. Just 1 mg background... I think that might work... otherwise, it's gonna be a lot of effort. I'm just going to get some of that, if you are ok with that.

CK: What did the doctors say about the speaking valve?

Nurse: Not much, just continue weaning. He is starting to be twitchier, isn't he? You are doing very well Jason! We are going to get you back into bed in a little while, ok? We will sit you up just for another 10-20 minutes or so. You are doing very well! Are you warm enough?

Nurse: He got tired. Yes. So his saturation has dropped a little bit to the 88% and the patient is getting a bit more restless, so I think I will take him off the speaking valve and re-inflate the cuff, and leave him on T-piece and see if that's going to bring his saturation up.

Nurse: Ok, just relax, I'm just going to change your breathing slightly again. So we will sit you up for a little bit longer, because you are starting to get tired now. Ok, saturation is back up to 97% since I took the passing valve off.

Nurse: So now he is back into bed and looks more rested, not as much agitated. I think he seems to be doing very well on the T-piece. We have put him on T-piece at

about 10:15 am, so he's done 2 hours so far. So I don't think I'm going to push him more than a half an hour more, I'd rather not push him too much and try to put him back on T-piece later on today. I feel that it's a sign if you are getting too tired then agitation is one of the primary sources to show that. And because he was agitated, you can say now that he is back to his bed, I could conclude from that that he was overly tired and put him back onto ventilation. So, I will put him back to the ventilation and maybe give him another 2 hours later on T-piece, and that would make it 5 hours today, which is more than he had yesterday. And he had about half an hour on the passy-muir valve, as well, which I think is slightly a bit more from what he did yesterday. So, I think that would be a significant improvement for him. I think his progress is probably limited by his agitation, which is why I suggested to the consultant to give him some regular valium to see if we can get the edge of him off. He was on a clonidine infusion yesterday, and I think, he is obviously a very heavy drinker, so to go from heavy drinker to clonidine infusion and to nothing is too much for him.

I asked the nurse who makes the decision for starting weaning.

Nurse: I think I'm going to put him back on to the ventilator just before I go for my break electively, although everything looks fine, his respiratory rate, his saturation is at 97-98%, he's got heart rate of 80, his blood pressure is a little bit higher now since we put him back to bed. So in paper he seems quite good, so I think it's not worth pushing this man too far.

CK: How often do you check blood gases? Do you go by the blood gases?

Nurse: Normally we would, of course if you have an arterial line. I mean I tend to do 3 blood gases a day unless there is a reason of why they should have less or more. I think for the mean patient we don't need to do a blood gas of more than once a shift. You have your saturation, your respiratory rate and Vt you have most of the parameters on, so I think unless something changes, once a shift is adequate. And, of course, when you are changing him to a mode that has not been on, your T-piece trial the first time, then you should do a blood gas when you have changed a significant portion of ventilation. Otherwise if they carry on nicely I don't see the need for it.

Carrying on my reflection, I remember when I was trying to tell you earlier on that I wouldn't put him on T-piece while he is sitting, and you asked me 'why'... not challenging but what's your rational and then well I did verbalize it and I thought there is really no reason why you couldn't try it, unless you think that T-piece trial and sitting up together was too much for him. And that's when I said that sometimes you go with cautiousness, if you don't know the patient, and he's been here for a number of days this gentleman, that's day 17, sometimes you do have to go more softly. But there is also other patients who you have to push because other nurses might be going too softly, but you can actually push them even further, but I think when you come across a new patient, I think you have to feel comfortable and you have to get to know how they are like, because you can't always say that you have a go, which will work for all the patients. You might say that patients on X ventilation they should be able to cope with Y, but it's not always true, so I think a lot is actually

trial and error and being able to recognise when the patient is doing well and when the patient is doing badly and hopefully changing that ventilation before becomes extremely tired. We shouldn't be pushing them beyond the point that are getting tired, we should be working them hard as we did this morning, but I don't want to work him overly hard, I think, with him. He would experience a lot of agitation that was his primary sign that he wasn't coping.

Nurse: A lot of decision-making is based on reality and I've done an intensive care course, but that was a while ago and nevertheless I've done ten years of intensive care, so I've seen pretty much everything and see what works and what doesn't work and I think that sometimes when you do this a little bit longer is actually difficult to explain why you are doing it, maybe it's a gut reaction, but you should be able to justify what you are doing all the time, not just with weaning, but any other form of treatment that we are doing here in ITU. So, hopefully, I can give some sort of reason, what it doesn't always work. Even when you have so much experience you think this would probably work, but other times it just doesn't and you have to accept that each patient is so individual situation, so that's why again I don't think you can formulize things. I don't think that doctors and physios can come in and say you will change the patient's ventilation to bla bla bla for an X time, because this has to be based on the nurse's experience to see what the patient will do to cope with that. And we are on the best position because we are here with the patient all the time, so we can judge. I have to say that sometimes we can be too close and sometimes you do need someone externally to give you some guidance. I think that's more with the junior staff, I think. I think here most of our programs are initiated by the physios. I don't think that's always terribly right, because there may not be physios who are based here all the time. I don't think they can come here and do a weaning program. But most physios don't provide some sort of weaning plan, they make a recommendation based on their assessment, they don't make things very specific. I would only take it as a guideline, while other people would take it as an order. But as far as I am concerned, no physio orders me to do something. I very much appreciate their role as an advisor to us, but as far as I am concerned I am the one who is going to decide on the patient's breathing. Obviously the doctors, obviously they are going to give us the instructions and physios are going to give their advice. I think that's the way it should be. It should be us, the nurses, deciding if the patient is suitable to wean using all the information that is available. It's more patients with a tracheostomy who would be on a weaning program.

Nurse: I think I'm going to measure the patient's blood pressure and put him back on to the ventilator and then it will be time for lunch. I think he's done very well today. He managed about 3 hours on T-piece. Jason, I'm going to put you back to the breathing machine to have a little rest. You've done very well, and before I do that I'm going to make you to have a little cough to clear your chest.

## APPENDIX 4.11B OBSERVATIONAL NOTES

OBSERVATIONAL NOTES: 5TH NOVEMBER 2007

PATIENT CASE ...

The charge nurse decided to introduce me to Steven who was looking after a weaning patient and was in bed space 16. When I went into the cubicle where that patient was, the night staff nurse was handing over to Steven, who was going to look after the patient today. So I introduced myself and explained the reason why I was there, and asked for permission to listen to the handover. The nurse was very friendly and cooperative. Steven, then, gave me a brief summary of the patient's history and condition.

Today, the patient was on CPAP, no PS, just PEEP of 5, on 40% O<sub>2</sub>, and his RR was 30, Vt: 400, Peak Pressure: 7 and SpO<sub>2</sub>: 98%. His last blood gases, on the 3rd November were PaO<sub>2</sub>: 12-13, PaCO<sub>2</sub>: 5-6, BE: 7, HCO<sub>3</sub>: 38. His chest was productive, mucopurulent secretions with suctioning and he has been PEEP dependent, because he desaturated when attempts of reducing the PEEP were made. Cardiovascularly, he was stable without inotrope support, but he was pyrexial with T<sub>max</sub>: 40°C yesterday and 37.5°C today. His GCS was 10/10 but he became agitated at times. His RASS sedation score was +1 to +2. He was also feeding and his renal function was normal with normal U&E's. When I went there he was trying to pull out the arterial line and the nasogastric tube, which signified that he was restless.

I started observing the nurse. Steven, the nurse, assessed the patient; first, the neurological status, then the breathing. He listened to his chest, watched his respiratory pattern and parameters on the ventilator and the monitor. He said that the patient's air entry was clear throughout both lungs. Steven glanced at the latest lab tests. The Hb was normal and the WBC has been stable for days, although the patient had an ongoing chest infection.

Steven referred to his plan for the day in relation to the patient's breathing. He said that he was happy with a RR<40, SpO<sub>2</sub>> 95%, Vt: 400 and that he would 'take it from there'. He said that he was going to try him on T-piece, but sit him up on the chair first. However, Steven commented on the fact that it is not documented anywhere if and how the patient is mobilised, since most information is passed on verbally at the handover.

The patient was mobilised at 8:45 am. I put on my apron and gloves and helped the nurse move the patient. We hoisted the patient and put him up on the chair. Steven said that his plan was to keep him sitting on the chair until 12 am. The mobilization went smoothly. However, the patient's SpO<sub>2</sub> was 88% after just moving him but the nurse did not act. He waited until the patient had settled. After a few minutes the patient's SpO<sub>2</sub> increased until it reached 95%. The patient coughed and Steven suctioned him.

Steven claimed that he would rather not try the patient on T-piece while he is sitting and that he would try that when the patient is back on to his bed. I asked him the reason of his decision. He said that he has seen many patients getting distressed when pushed too much, and that he preferred doing one thing at the time, and not together. However, at the same time he looked as if he had second thoughts about that decision; he reflected being on the chair would be the best time to try him on T-piece, because the patient is in the best position for his chest to work.

‘I guess you can decide better when you know the patient and know his reactions. You can just try and see, I guess!’

At 9:00 am the SHO came to assess the patient and make a plan for the day. He wrote on the medical notes that the plan is to try to wean him more today.

At 9:10 am, the physiotherapist came to assess the patient. He listened to the patient’s chest, and then decided to suction him and then manually ventilate him. The physiotherapist suggested trying him on T-piece again and continuing to wean. Physiotherapists make suggestions about weaning plans for the patients. Their input and information they give is documented on the medical notes. They have a list of weaning criteria which they follow when they decide about the patient’s weaning, but do not follow them not strictly. It is mostly a list of parameters to initialize weaning. Their input is very important on weaning and it is taken into consideration by the nurses and doctors.

At 9:30 the nurse had his breakfast break and I joined him.

At 10:00 am, Steven came back from his break, and decided to put the patient on T-piece. He observed that the patient looked comfortable, his RR was 28, he had good cough reflex and his SpO<sub>2</sub> was 98%. The only concern was that the patient’s BP was low, but he said that the patient always had a low BP with a MAP 60.

At 11:15 am, Steven decided to put the patient on the speaking valve and see how he would react. It was the first time that the patient had a trial on the speaking valve.

At 11:30 am the ward round started with the consultant, the registrar, the SHO and the bed space nurse. They talked about the weaning plan and they decided to try him again on the T-piece. They talked about the ascites and the possibility of draining, because that would possibly help his breathing, and that they would talk to the GI specialists to assess the patient and make a decision about it. They also talked about the patient’s agitation, so they decided to prescribe diazepam. During the ward round, the nurse’s input was related to the patient’s ability to be weaned and to the management of his agitation.

Doctor: So, J T, day 17, alcoholic disease, sepsis, lung disease, known diarrhoea, now he is on a slow wean from respiratory point of view. He was stable overnight, sitting out on his chair this morning; he is not on any sedation onboard, clonidine was stopped yesterday...Respiratorily wise, he is on 40% O<sub>2</sub>, sats are 99%,

secretions MP1, trache, he was on CPAP with PEEP 5 initially, and on T-piece later on, which he is on just now...

Consultant: He is on T-piece... yes

Nurse: T-piece and passy-muir valve

Doctor: Air entry in all fields; otherwise he's got good air entry throughout. Cardiovascularly, he's been sinus, with a MAP of 85 warm and well perfused, swollen ankles. Abdominally, bowel sounds, some tenderness, he was sitting down, so it is a bit hard to say from his examination, but it looks distended as well. Renally, he was positive yesterday 150ml. Neurologically, he is GCS 15, he's got a bit of tremor at rest. Micro wise he was 37 degrees this morning but he was pyrexial yesterday up to 39, recultured. He was put on vancomycin and cipro yesterday, day 2. He is on Thiamine, spironolactone, Sando K, frusemide, and the antibiotics I mentioned. So he seems reasonably stable just now, reducing some of his respiratory support, pyrexia seems to have settled now with the antibiotics. We just have to wait what the cultures are.... So, he needs to carry on sitting, although not very cooperative at times,

Consultant: I was wondering if he was a bit PEEP dependent because of his ascites, I had a quick tap while sitting and it felt like it was distended, so it's definitely good to get an ultrasound and see how much ascites there is, but is also worth increasing his spironolactone dose if his ascites persists, to get rid of it.

Doctor: Is there anything going on with his bowels?

Nurse: He's not have anything overnight but I think he had loose stool yesterday.

Consultant: Put the spironolactone up to 200mg, if you see lots of ascites from the ultrasound and I think we just continue the weaning with the T-piece.

Doctor: Hb is a bit at the low side, so we might need to transfuse him.

Consultant: Well his urea is high, so I suppose it's not a good idea to do it. What's his back fluid balance like?

Nurse: Probably about minus 400 because of the morning frusemide and spironolactone.

Consultant: And was he negative yesterday?

Nurse: He was plus 115ml.

Consultant: So, ultrasound, put the spironolactone dose up to 200mg, if he's got a lot of ascites, just keep an eye on his fat level, he is the guy who became very toxic last time.

Doctor: Anything else for him?



Consultant: So nutrition wise, he is feeding well

Nurse: He is feeding well, he never had anything orally at the moment. I was trying with a little bit of water with his cuff down.

Consultant: yes, see if he will do that, yes.

Nurse: What you feel about a little bit of background valium for him?

Consultant: Actually I thought that would be the best thing for him to have 1 mg of Lorazepam, but he became unconscious, that was on the weekend. He was on Midazolam, so I thought it was not good acting.

Doctor: With diazepam, I always think it's... 2 mg of diazepam would make me feel unconscious.

Consultant: Do you want to try with 1 mg of diazepam and see how it's going to work?

Nurse: yes, we could try that.

Consultant: Just try to keep a little bit at the background and see how that goes. Do you think he feels distressed?

Nurse: We have put the speaking valve on and I think he is completely disorientated, I think he's got no awareness of space, time, orientation what so ever. He' not been too bad. He' been picky...

However, at 11:45 am the patient became more agitated while on the speaking valve and his SpO2 came down to 88%. Unfortunately the patient did not have an arterial line, so the nurse could not check a blood gas. He based his decisions on the parameters from the monitor. Steven also assessed the patient's breathing pattern just looking at his chest moving. Steven remarked that his breaths looked very shallow, so the patient was taking low VT. Steven decided to take him off the speaking valve and put him on T-piece again as the patient had signs of fatigue.

At 12:15 the patient became even more agitated and restless which Steven assumed was a sign of becoming tired. The patient had also moved his bowels, which was also a reason for the agitation. Steven decided to put him back to his bed and I helped him do that. While we were trying to hoist him back to his bed, the patient became violent. The nurse gave him diazepam so as to settle down and not fight back, because that would make him more tired and would not help his weaning.

At 13:00 pm, Steven decided to give the patient a rest and he connected him back on to the ventilator. He said he would try to put him again on T-piece in the afternoon at about 4 pm.

Steven went for his lunch break at 13.15. After coming back from break the patient looked much more settled and he was sleeping. I decided to stop my observation and thanked the nurse who volunteered to participate.

## **APPENDIX 4.11C SEMI-STRUCTURED FOLLOW-UP INTERVIEW WITH A NURSE**

### **TRANSCRIPT OF FOLLOW-UP INTERVIEW WITH A NURSE**

CODE NUMBER...

CK: I will start with a broad question. How do you wean a long-term mechanically ventilated patient in this unit?

Nurse: How do we wean them? I think it is very individual to each patient. It varies greatly between the individual patients, and consultants. Occasionally you will see a weaning plan, a sheet devised by the medical staff and between the physiotherapist and the nursing staff. We can carry that out. Certain settings for the night and certain settings during the day, certain settings for a couple of hours, you know more support, so occasionally we would do that. And many times, it is the medical staff, the consultant who does it, and other times it is very much nurse-led. So there is a huge variation.

CK: And why is that?

Nurse: Why is that! I would say it is because there is no perfect answer. It is all a very individual thing. We have made a great effort to institute certain weaning plans as a rule, and they are good for a while, a lot of people have them but they seem to subside again; you know less people have them, they seem to be less popular for a while. I think it very much depends on which consultant is on as well, there are some consultants who are very positive towards them.

CK: To a weaning protocol.

Nurse: Yes, to a weaning plan, an individual weaning plan. We did for a number of years, we introduced the weaning protocol, which was very interesting, very good, but it proved to be not very useful to the long-term weaner. It was very good for the first four days, but patients who were intubated for greater than four days, proved to be a brutal tool. They had to drop the pressure support by 2 every half an hour or so, keep an eye on the respiratory rate and tidal volumes and that was great when people had a respiratory reserve, because they have just recently been admitted. But for the longer than four days, it was too aggressive. The actual weaning protocol was too aggressive. So, what we are left with, I would say is unsatisfactory as uniform, you know. And as I take charge often, night time as well, I think what you find is the frustration to the consultants and medical staff, the patient's support and ventilation yoyos. They come during the day, they reduce the ventilation and at night time we are struggling to put it back again. I think that is a bit of phenomenon that we have as well. Yo-yoing of support. So, probably we don't have anything that is truly adequate a uniform policy.

CK: My second question is if you have a protocol, but you have already answered that. Which criteria or factors influence the decision-making during the weaning process?

Nurse: Well, I think the really important factors are probably the person's tidal volumes, their respiratory rate, and how well they look clinically. How comfortable their breathing looks from the bottom of the bed. Is it laboured or not? So, I would say it is these three main factors. Is that what you are after?

CK: yes.

Nurse: So, we monitor these, we take these into consideration and we decide a reduction. That combined with saturation monitoring; end tidal CO<sub>2</sub>, in particular the blood gas analysis.

CK: What is the role of the nurse during the weaning process?

Nurse: Well, that depends on the experience of the nurse I would say. Myself today, I was keen to reduce his support as I felt able. I would say more junior nurses would be more reluctant to do so. They would look for guidance from either the nurse in charge or a senior nurse or from the medical staff.

CK: So, it really depends on their experience.

Nurse: Yes. The role that we all have is the role of monitoring, to see exactly any changes of the ventilation and how they affect the patient. So, we all have a role in monitoring the respiratory function. But to actually make a decision to reduce the support, I would say that it often depends on the level of experience.

CK: What decisions do nurses make concerning the patient's weaning?

Nurse: They often make a decision when it is time to flip them between one mode or another, from SIMV to ASB, the medical plan would be to wean them to ASB when that is appropriate, and the nurse will monitor the patient and take it upon himself to flip them on the other mode of ventilation. So, we often do that. I think we should have the confidence to be able to reduce the pressure support and, of course, their oxygen based on blood gas analysis, in particular, and the saturation monitoring. We should have the confidence to reduce the oxygen and the FiO<sub>2</sub>.

CK: So, the main decisions are to change the mode of ventilation, you can make that decision as well.

Nurse: Definitely yes. In patients where there would be a simple plan, and the plan was to put them from SIMV to ASB and then to reduce the ventilation; that often can be discussed in terms of we can wean them. In more complex ventilation modes, people who have been here for a long time and who have a high ventilation requirement, high support requirement, I think that it would probably depend on whether we should be reducing the support, it would depend on what level of support

they are on. For example, somebody who is on 100% BiPAP, 24 breaths, a large pressure by a large PEEP, and looked as though there was room for weaning, I would take that, as everything else that is going on with the patient, it would be appropriate for us to wean the ventilation and maybe to pass that on to the medical staff as well.

CK: How does the nurse influence the care of the weaning patient?

Nurse: How do we influence it? I think the care of the weaning patient is one of the most important roles that we have in here. I think the nurse has to be proactive, again put him on the right position, sit him up, optimising the chance to take good size breaths, with encouragement, and you know when we see that we should discuss it with the medical staff and push for further reduction of the ventilation. Or we can influence by being proactive and get them to a good position and encourage them to deep breathe. Encourage them to participate in physiotherapy.

CK: Do you think we could improve nurses' decision-making during the weaning process and how?

Nurse: It probably seems easier than it actually is. When we first brought out the weaning plan, it seemed very simple. You would record the tidal volume, you would record the respiratory rate, you would divide one by the other and you would get a sort of a number, and if it was less than some sort of number, then the patient would look good to wean. We also had another ratio; we would look at the blood gas, we would look at the PaO<sub>2</sub> particular and the amount of oxygen they were on and we would divide one by the other and we would get a figure. And that seemed quite easy and of course it is not that easy. It is probably not to be like that. What was the question again?

CK: How can we improve nurses' decision-making?

Nurse: How can we improve...yeah. I don't know if a flowchart is particularly the way to go. A weaning protocol. I don't know if that is particularly the way to go. Because it has proved as we have tried it before, it is really good for people who are ventilated up to four days. That particular protocol was good only for people who have been ventilated for up to four days. And they are people who are quite easy to wean. You know for people who have been in for longer than two days and are more difficult to wean, they just cannot be weaned by a flowchart. The flowchart to me was very useful and I have highlighted a few very important things about that, the ratio of oxygen to PaO<sub>2</sub>, respiratory rate to tidal volumes, I have highlighted these things, and that was very useful. But I don't think these long-term patient wean particularly well by a flow chart. I think we should be more proactive between ourselves, the medical staff and the physiotherapists and push for a weaning plan. A weaning plan based on the individual patient.

CK: I've seen this weaning plan that you say when I was doing my observation but I didn't really see it being used.

Nurse: No, because it was probably developed just to put it in the drawer so that would come out for 6 years and we introduced an audit, so greater than 6 years ago we introduced it, and when we moved to this site again, we tried to push it once again and we tried to encourage it, but all this, kind of, fell by the wayside, because an inexperienced nurse is reluctant to touch the ventilator, and people should be looking at the flowchart and then touch the ventilator. The more experienced nurse doesn't need the protocol anyway as they are more confident in reducing the pressure support, the PEEP, the oxygen. So, it really falls into middle ground people. So, we always struggled with that particular protocol, we always struggled.

CK: What is your opinion about teamwork in this unit and how does it affect the decisions during the weaning?

Nurse: Do you mean the multidisciplinary teamwork? Just generally teamwork. I think depending on some consultants that work particularly well within the multidisciplinary team and are more keen to get the physiotherapist and the nursing staff involved in and guided surrounding, particularly, a weaning plan. And there are others than seem to be less reluctant, I don't know if that's their priority or why they decided not to do that. I think the teamwork on the whole is very good. But just with regards to weaning I don't know, it doesn't seem to be optimised. I think it could be better.

CK: So, what should we do to make it better?

Nurse: I think we have had some success with the Scottish Patient Safety Program; the bundles. I think we had some success with that. And any of those elements, like the weaning protocol, are elements that we have pushed for years. You know sitting people up the bed. So I think it is another thing that you have to constantly remind staff about, you probably have to have a high profile initiative, you know all the consultants have to be on board, so that it becomes part of the culture. You know people are coming here and if they are not extubated within four days then they get a weaning protocol.

CK: A weaning plan.

Nurse: Yes, a weaning plan. So that it becomes part of the culture. That is very hard to do; it is very hard to do. It takes a lot of effort and you know you need to give them as much momentum as you can. And if you come to look at it 6 months later, you find that half of the patients have got a weaning plan. So, it is one of these things that you have to keep on pushing for. If that's the way you want to go. I couldn't say for sure that patients who have delayed weaning have longer time on the ventilator with this hassle way that we approach it as to a plan. I am not sure if that is the case. I would hope not. I would hope that every patient we are proactively weaning them. So, we are weaning them and I would hope that we don't have people on the ventilator longer. In order to look at that we would have to introduce a weaning plan and we would have to look at ventilator days, we would have to see if we get a reduction in the ventilator days by having a structured ventilator weaning plan per patient.

CK: And this will be individualized?

Nurse: Yes, yes.

CK: So, you mean, you will compare a weaning plan to another weaning plan to see if a weaning plan actually reduces or improves the time of ventilation. Is that what you mean?

Nurse: Yes, yes. Taking across all the patients all together, you know the ward watcher data, it would tell us a mean ventilator time. So you would pick a day, decide that we are going to use a weaning plan on a patient beyond the 4 days, get a weaning plan and stick to that quite rigidly and see after 6 months if we have made a reduction on the number of days.

CK: We might do that after the results of this study.

Nurse: Because I am here for a number of years, I am mostly nervous about the junior medical staff who have been here for a month, who are going to be here for three months in total, and I am always nervous when I see them playing with the ventilator. Because I have been here for 13 years, I am always more confident, if someone should be playing with the ventilator is a senior nurse, because the medical staff are here for a short period of time, I am sure they get to grips a lot with it, but the difficulties of weaning patients, I don't know if they get a true feel for that in the short time they are here. I've seen the consultants come and reduce the ventilation drastically. Sometimes I think this is a frustration on their part, don't you think? They think, goodness me, what is going on here, they feel frustrated. But then if the patient hasn't had the ventilation significantly reduced in 5 days, well, let's say if they had a weaning plan, to begin with, they would have had something constructive done. You know reduction of the ventilation, even if you had to put it back up again after a few hours. I've seen them do that also. I think there is a lot of inconsistency in the decisions that people make here, especially between the consultants because they change as well. Some of them are really aggressive and some of them are not that much. Then it depends on the nurse who is looking after the patient. Some of them are very inexperienced; they lack the knowledge to do so.

CK: Yes, yes.

Nurse: Or they are caught up with other things. In their daily role, they have to bed bath the patient, give the drugs, and make sure all things are ok, and maybe it is not a huge priority to them and that is a mistake of course. Because I come in here, I think that if I haven't reduced something with regards to the ventilation; you know to get them to the right direction to go on... I have seen the consultants and the medical staff to be very good in the weaning decisions. I mean I would say that the nursing staff are more keen to put the ventilation up, rather than reduce it; accept a lower PaO<sub>2</sub>, you could say that it is not up to us to accept any lower PaO<sub>2</sub>, we have to inform someone. But I do think that inexperienced staff in the middle of the night, I would go to them and their patient's pressure support would be double than what it was. It was 10 over 5, now it is 20 over 5. And I know it for a fact that the consultant

will come in the morning and be frustrated with that, because the nurse in the bed space has, not panicked as such but, has observed things that are not satisfactory and decided to put the ventilation back up. And some of the long-term weaning patients are, you know, we have to accept that they are going to have higher CO<sub>2</sub>, they are going to have non desirable PaO<sub>2</sub> often. So, sometimes we have to have a clear plan, a clear idea of what to accept from that patient. I think junior staff often want to optimise an agreed PaO<sub>2</sub> and to a normal PaCO<sub>2</sub> and you can't do that with the COPD patients.

CK: Great! I have finished with the questions. Is there anything that you would like to add?

Nurse: No, thank you.

CK: Thank you.



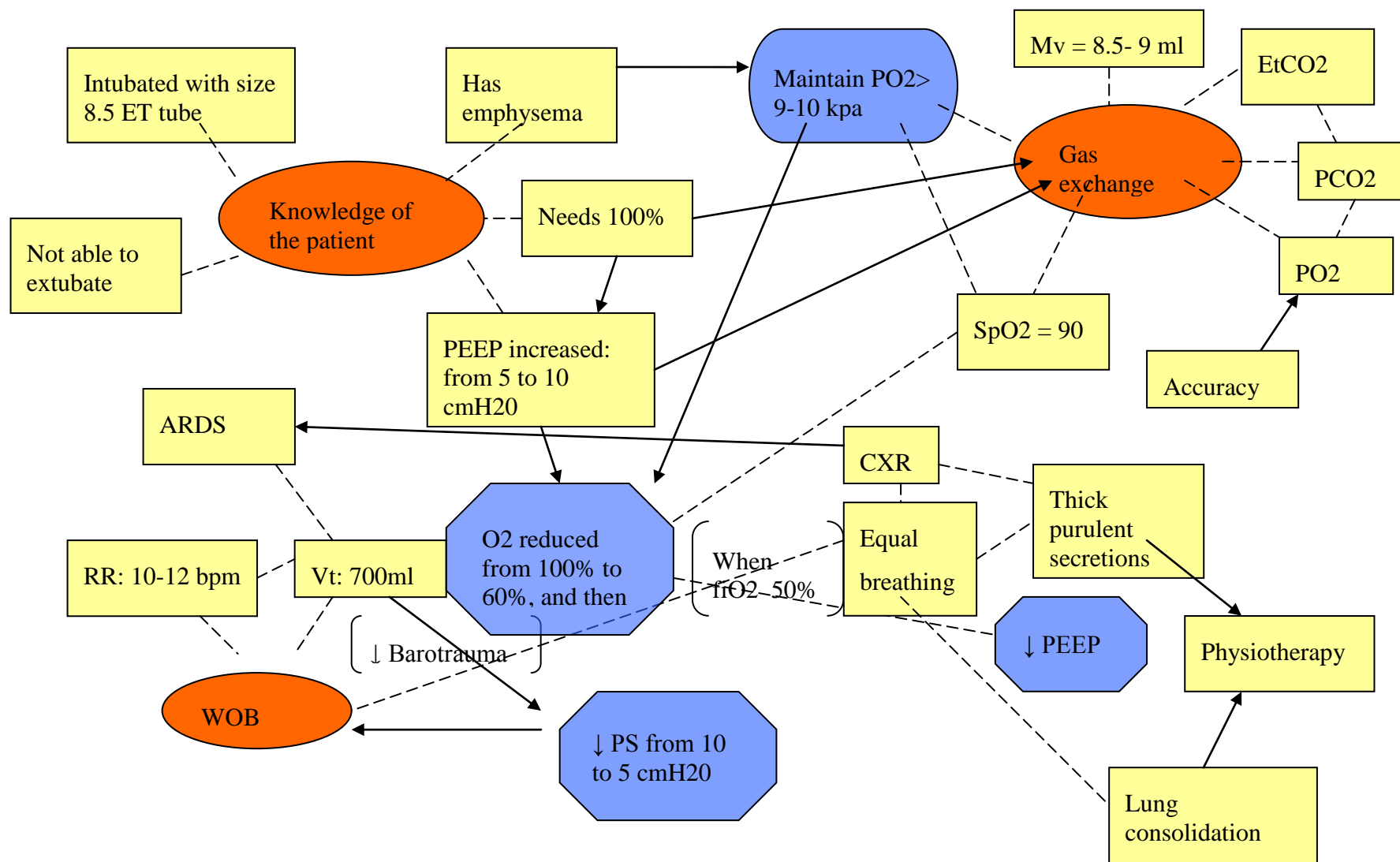
**APPENDIX 5.1 PATIENT SCENARIOS USED FOR THE AUTO-ETHNOGRAPHIC EXERCISE**

| MEDICAL HISTORY – PATIENT 1   | MEDICAL HISTORY-PATIENT 2  |
|---|--|
| <p><i>A 28-year old man was admitted in ICU with severe community acquired pneumonia. His chest x-ray showed a right septic pleural effusion and lobar collapse, which required the insertion of an intercostal drainage. He had a past medical history of alcohol excess. He had been fully ventilated on mandatory ventilation and required high level of oxygen, between 80-100% for almost 20 days. He also developed sepsis due to the infection and was treated with antibiotics. He required increased amount of sedation because of the alcohol withdrawal syndrome. He started showing improvement on day 20-21 from admission, when the level of oxygen requirements reduced to 40%, still requiring high level of ventilatory support. I observed the patient on day 22 since his admission.</i></p> | <p><i>A 35-year old lady was admitted in ICU with a head injury. She was found unconscious with Glasgow Coma Scale (GCS) 3 by the paramedics. Her CT scan showed that she had left frontal-parietal contusions. She had no past medical history. The head injury had been managed for 16 days and she had been improving. She had a tracheostomy performed on day 10 to facilitate her weaning from the ventilator process. The patient could not be extubated, because of her neurological impairment and agitation that made cooperation difficult. Hospital acquired pneumonia delayed her weaning. Her neurology had improved, and the GCS was 10. I observed the patient on day 17 since admission.</i></p> |

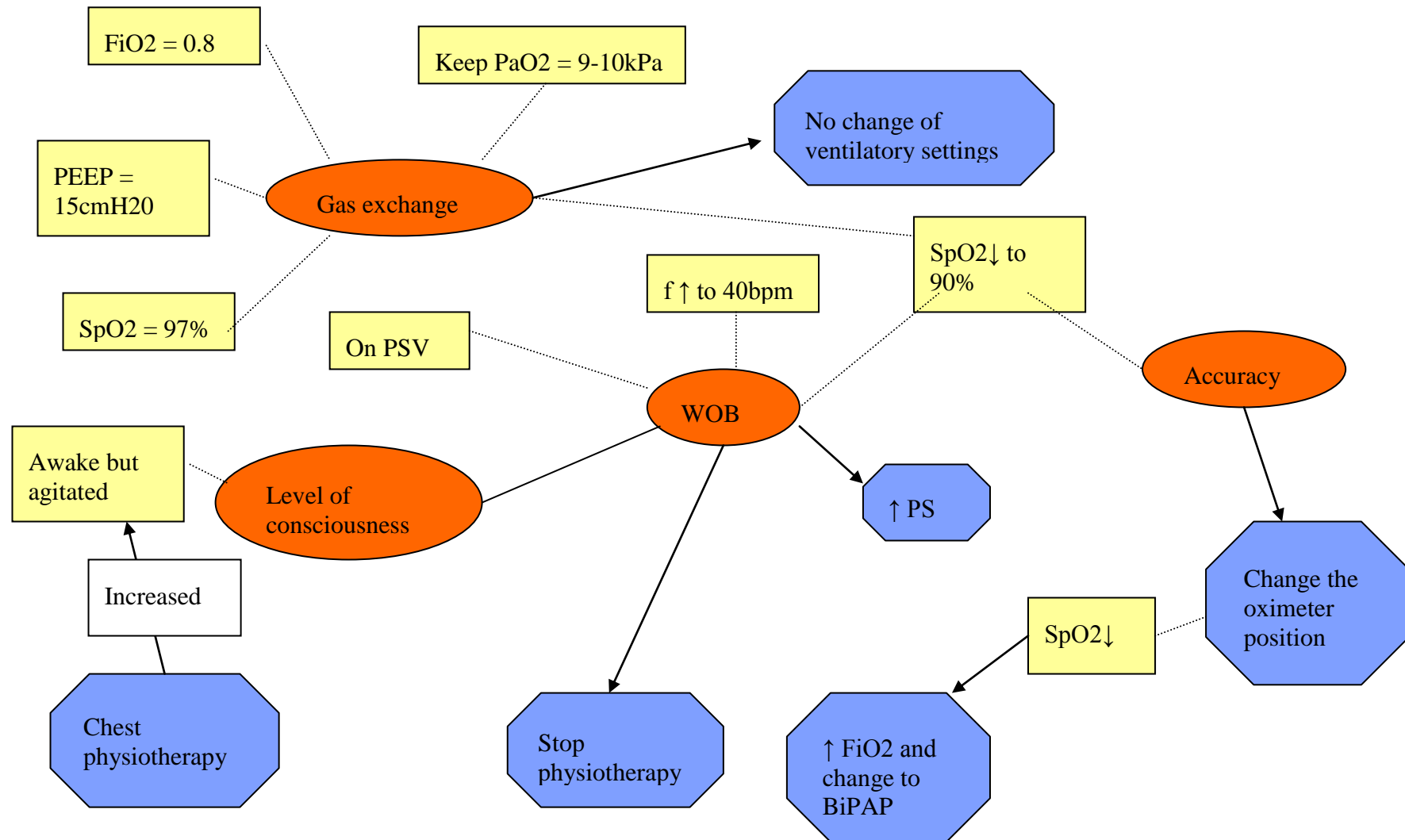
## APPENDIX 6.1

### CONCEPT MAPS

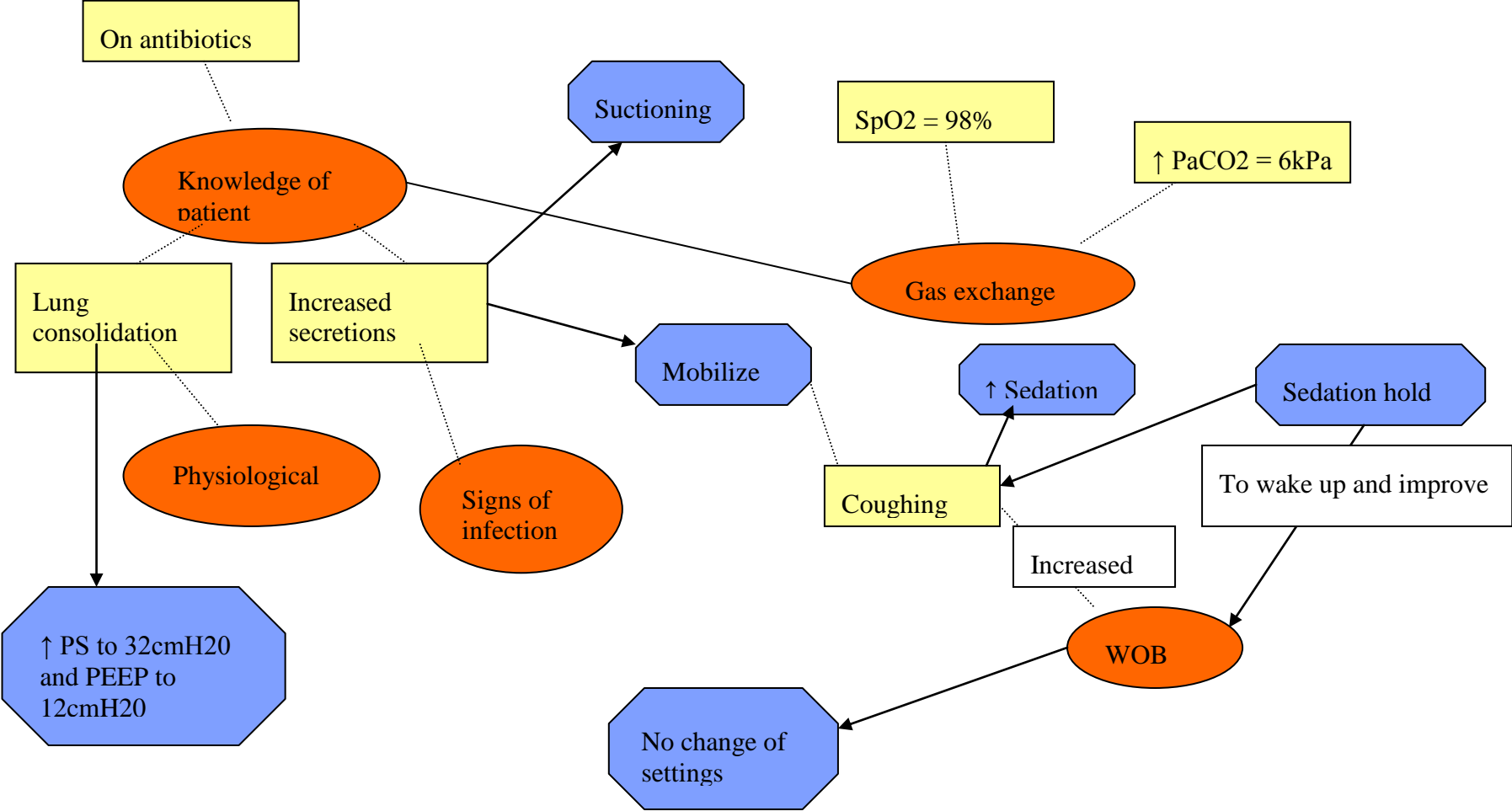
# CONCEPT MAP A – PRE-WEANING PHASE – PATIENT CASE 1 – NURSE A



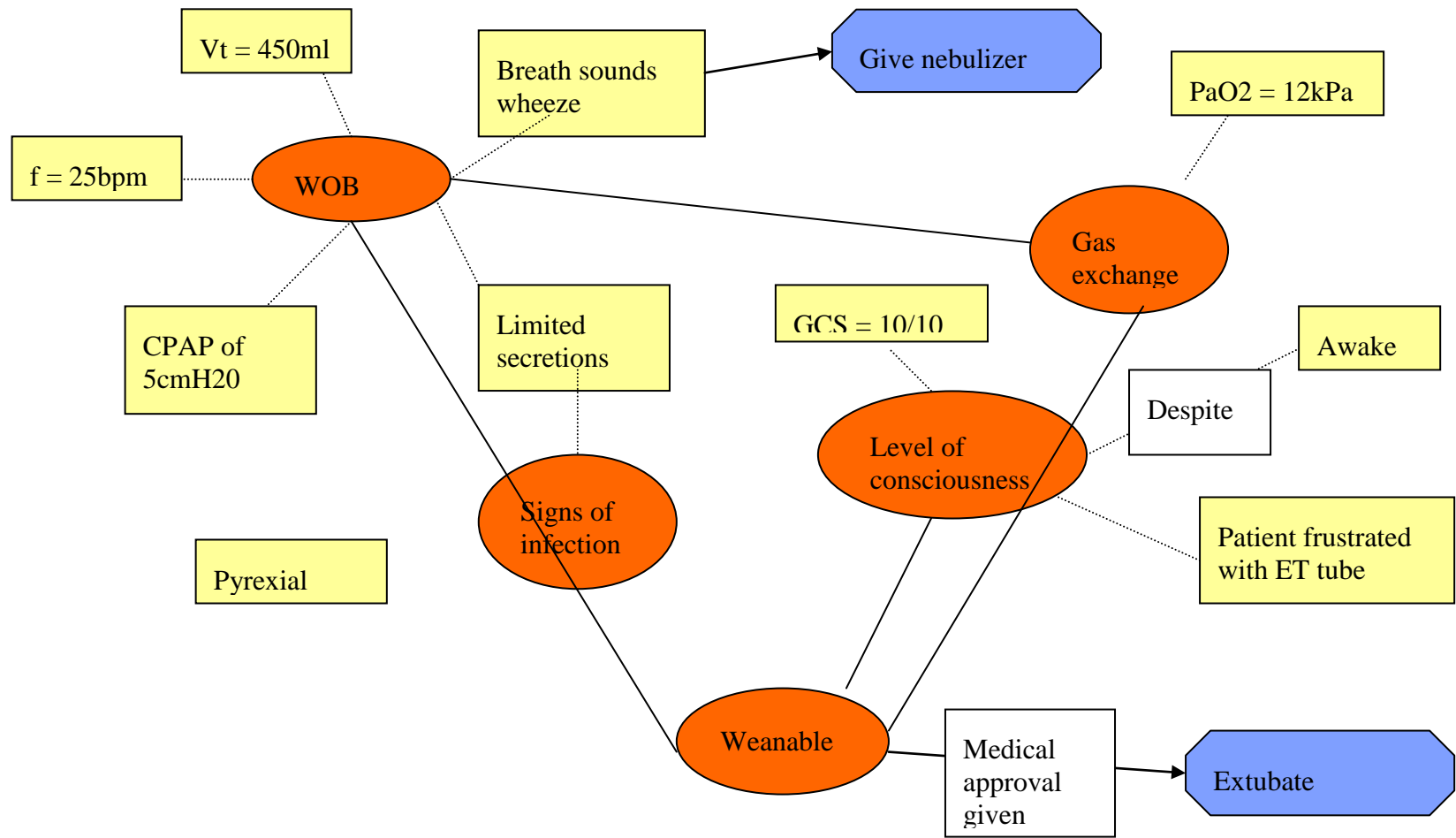
CONCEPT MAP B – PRE-WEANING PHASE – PATIENT CASE 1 – NURSE B



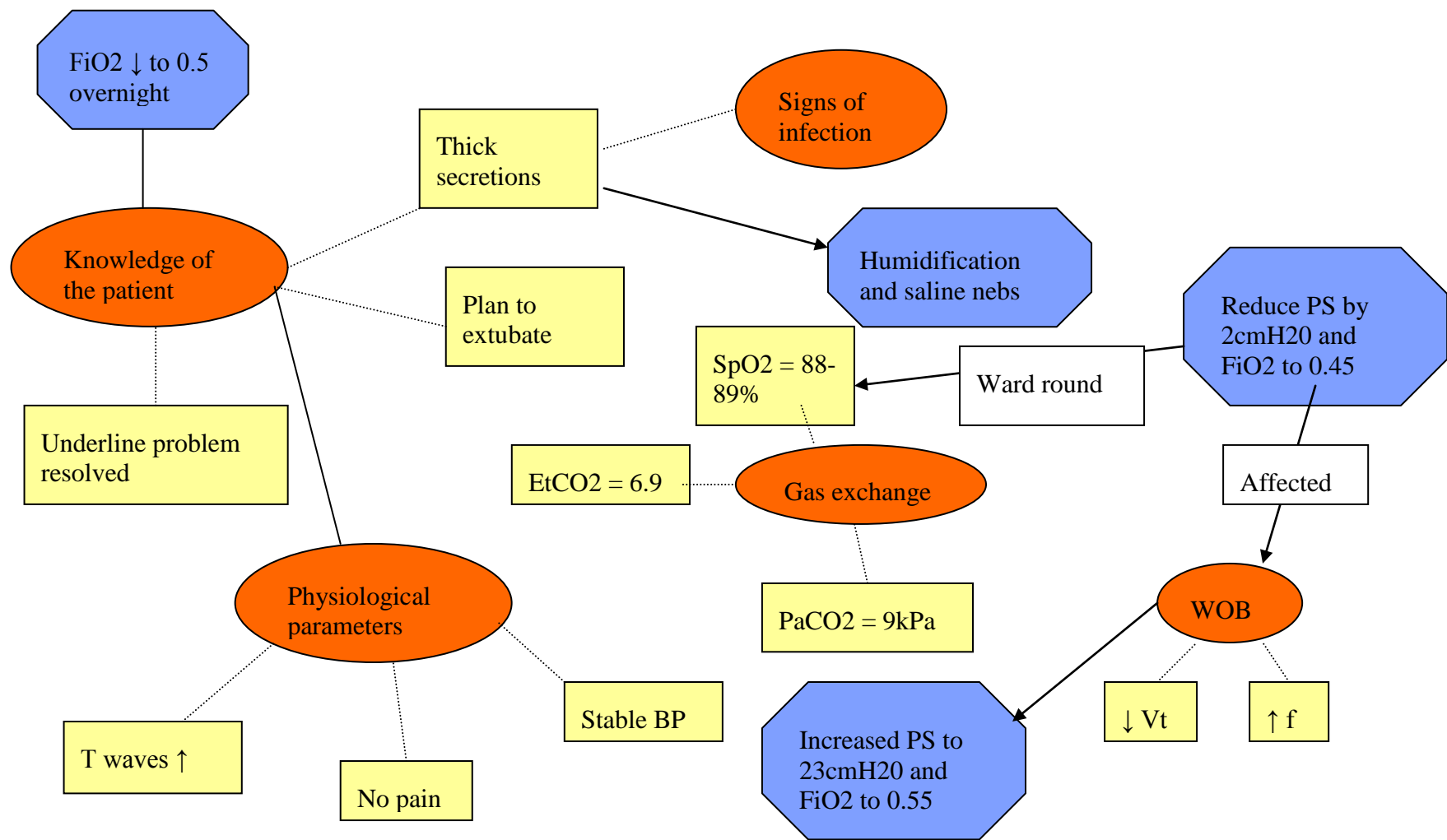
CONCEPT MAP C- WEANING PHASE – PATIENT CASE 2 – NURSE C



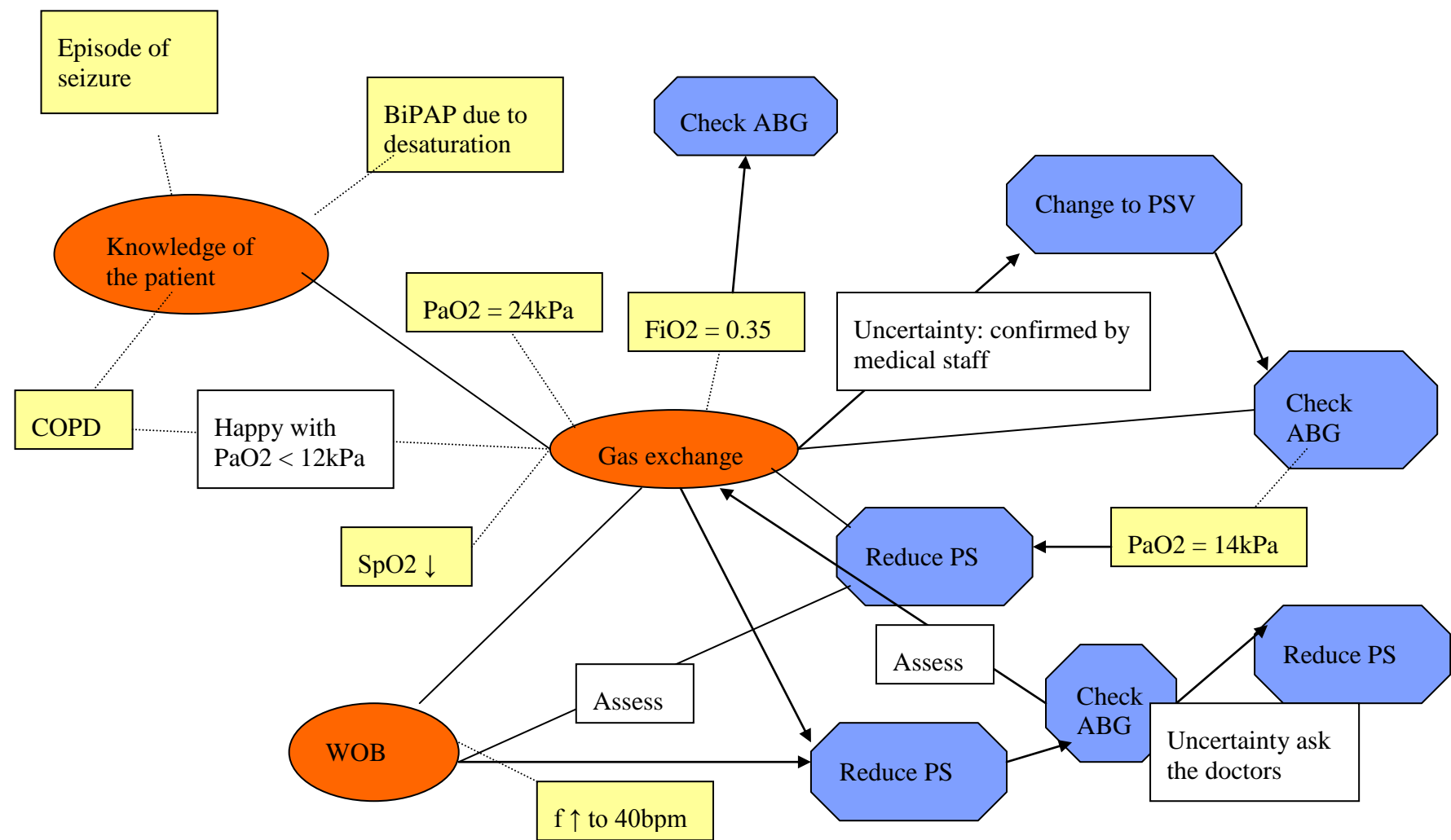
CONCEPT MAP D- SPONTANEOUS BREATHING TRIAL – PATIENT CASE 2 – NURSE D



CONCEPT MAP E- WEANING PHASE – PATIENT CASE 3 – NURSE E

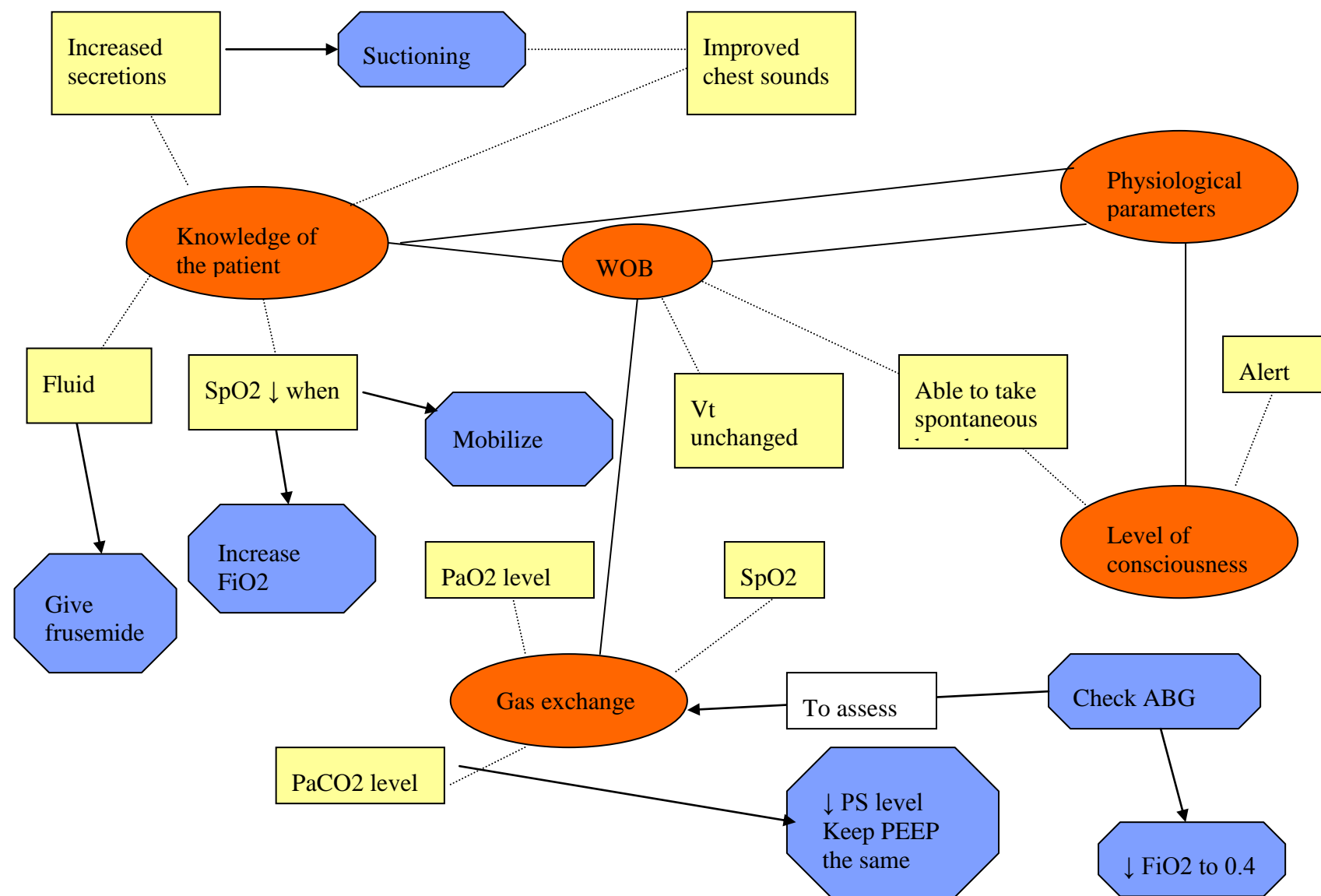


CONCEPT MAP F- WEANING PHASE – PATIENT CASE 6 – NURSE F

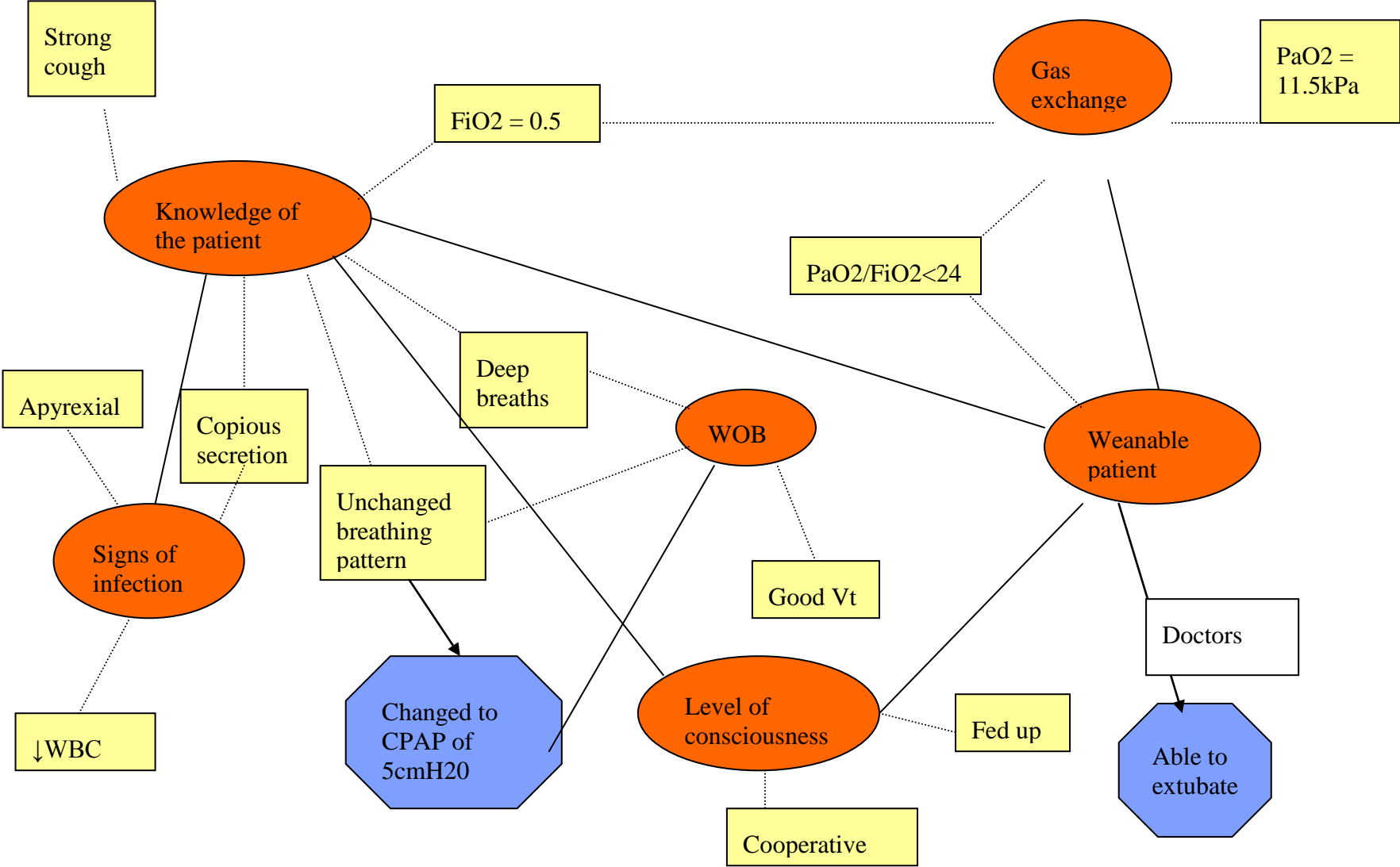




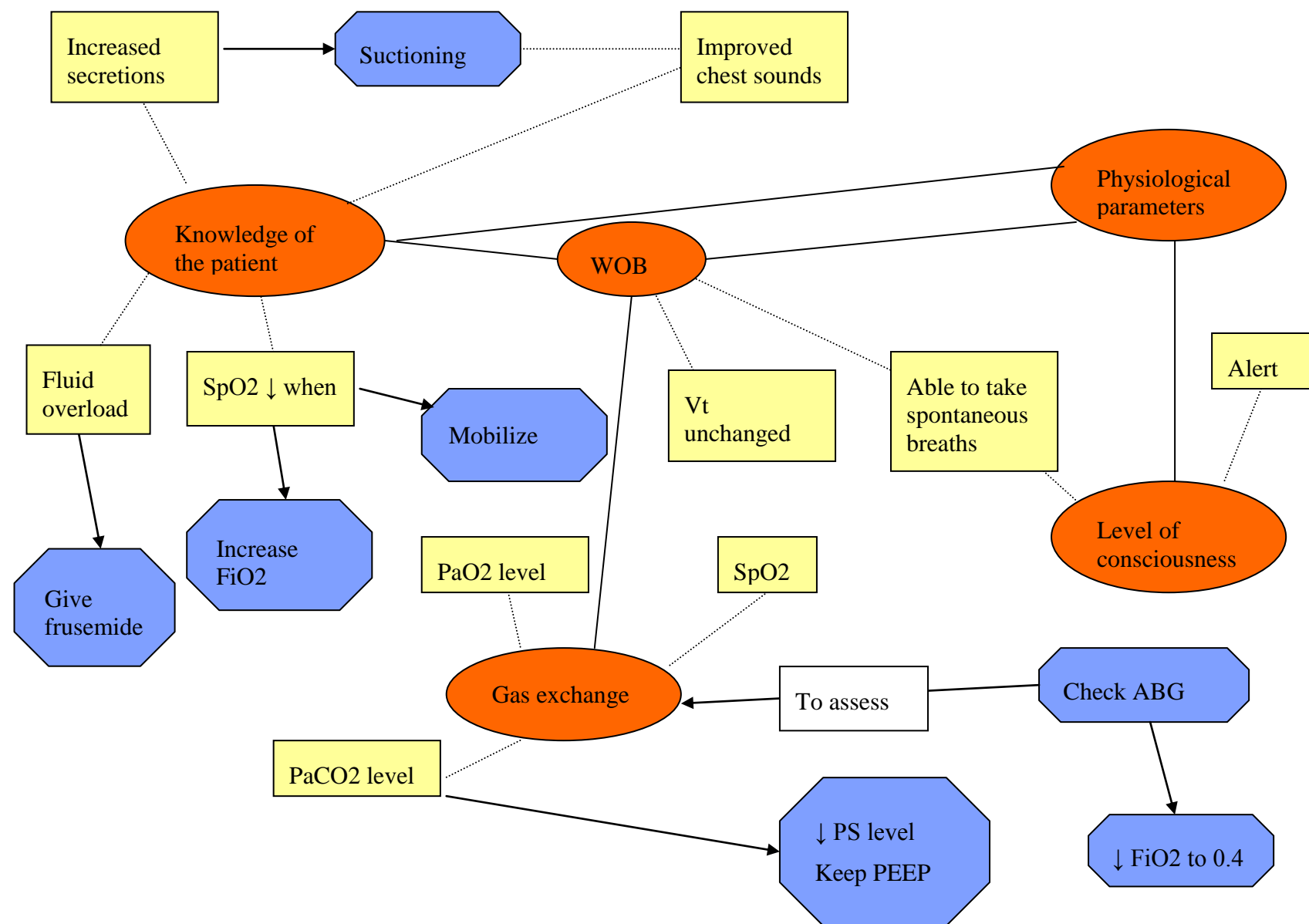
CONCEPT MAP G- WEANING PHASE – PATIENT CASE 10 – NURSE G



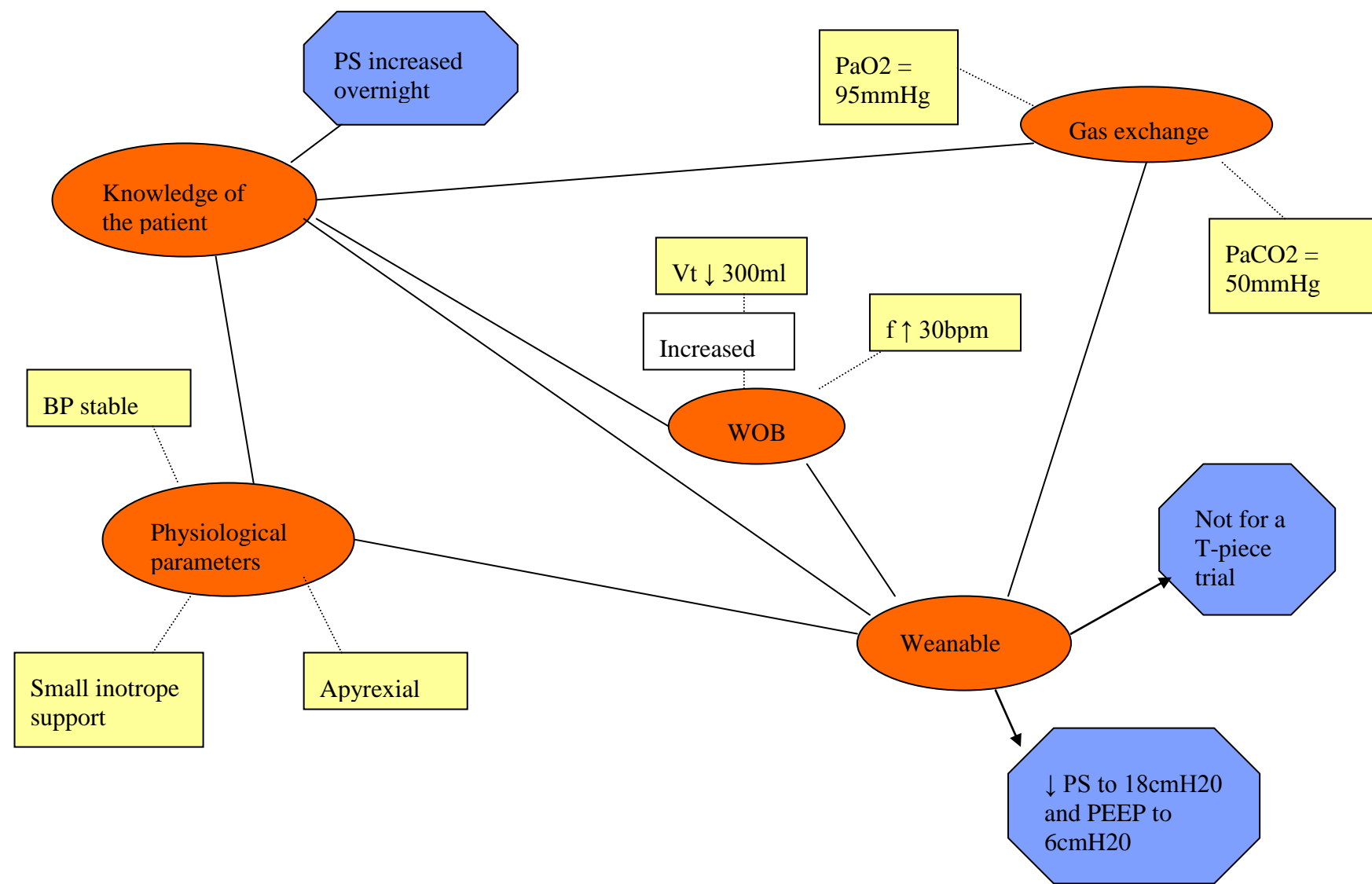
CONCEPT MAP H- SPONTANEOUS BREATHING TRIAL - PATIENT CASE 10 – NURSE H



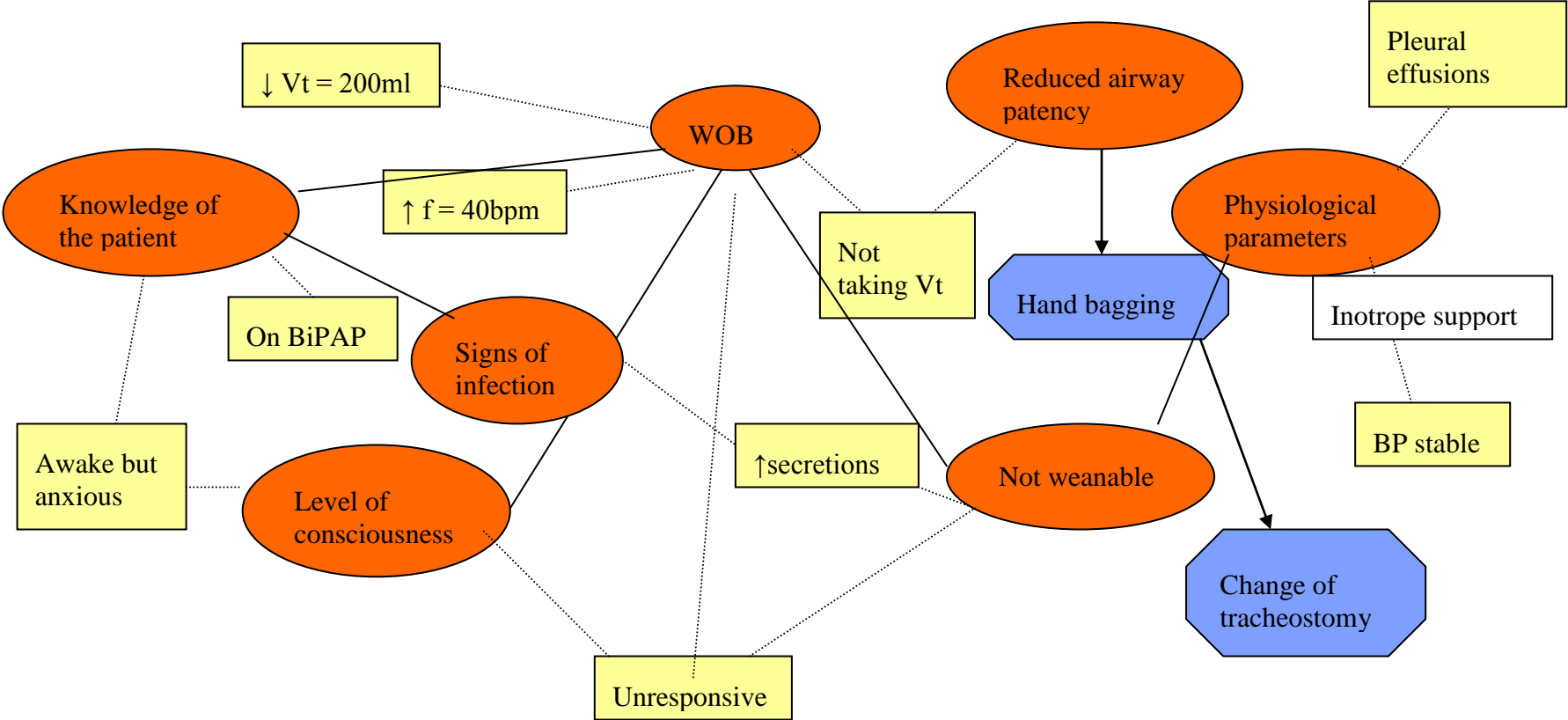
CONCEPT MAP I- WEANING PHASE - PATIENT CASE 11 – NURSE I



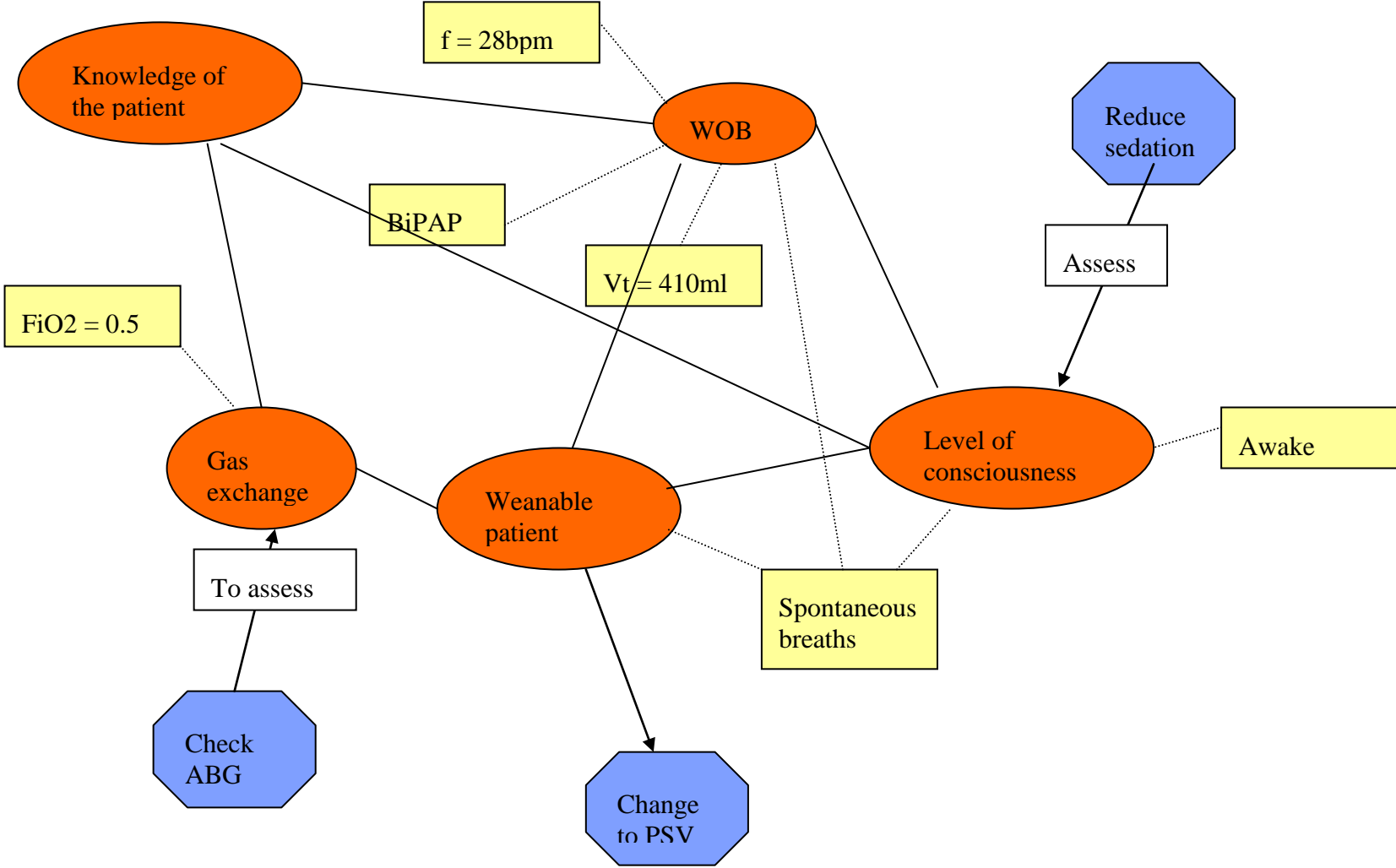
CONCEPT MAP J- WEANING PHASE - PATIENT CASE 12 – NURSE J



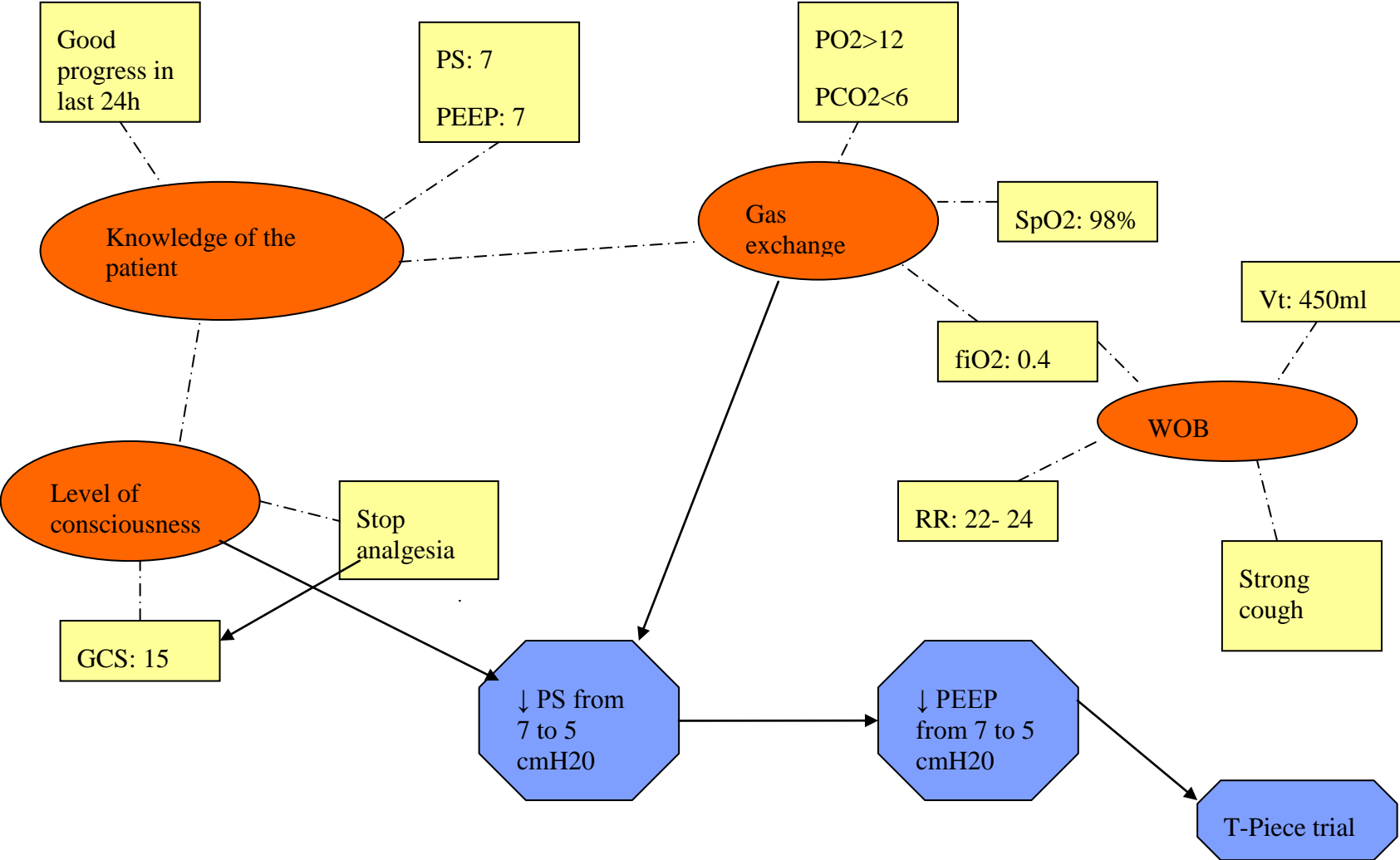
CONCEPT MAP K- EMERGENCY SITUATION - PATIENT CASE 12 – NURSE K



CONCEPT MAP L- WEANING PHASE - PATIENT CASE 13 – NURSE L



CONCEPT MAP M- SPONTANEOUS BREATHING TRIAL - PATIENT CASE 16 – NURSE M

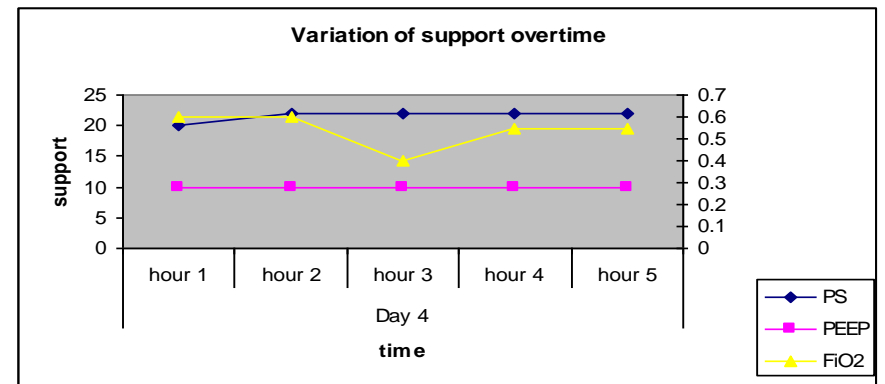
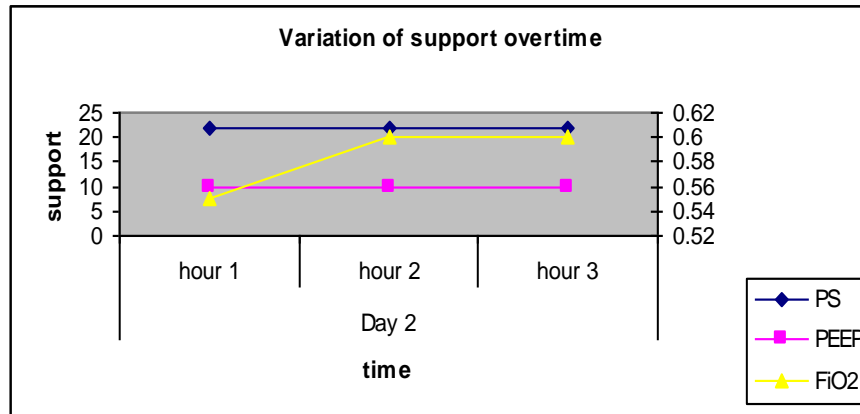
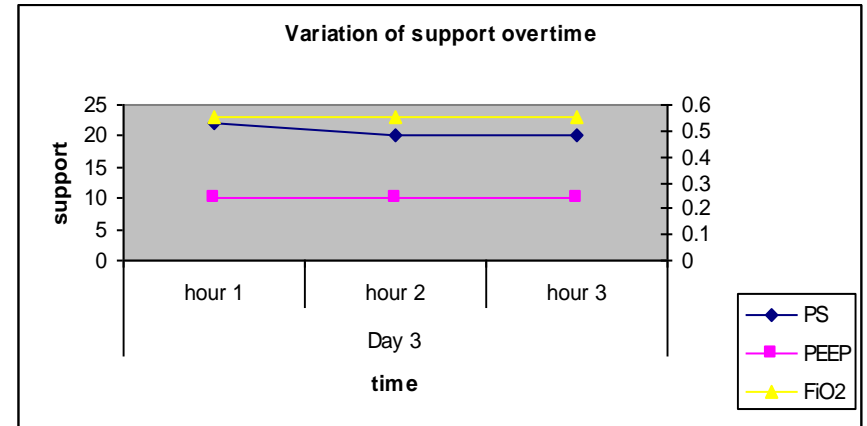
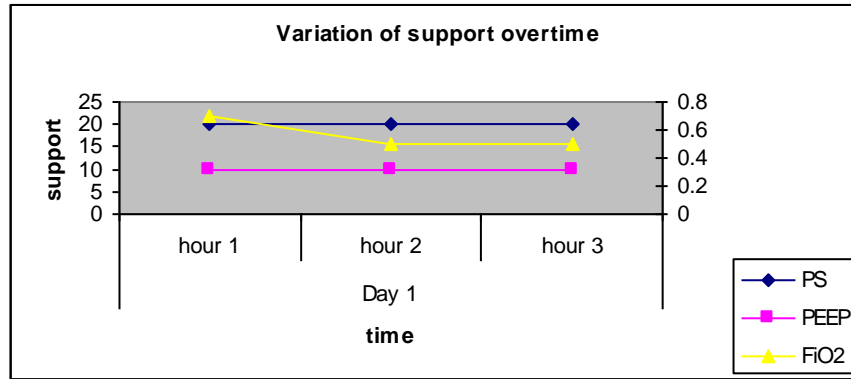


## APPENDIX 7.1

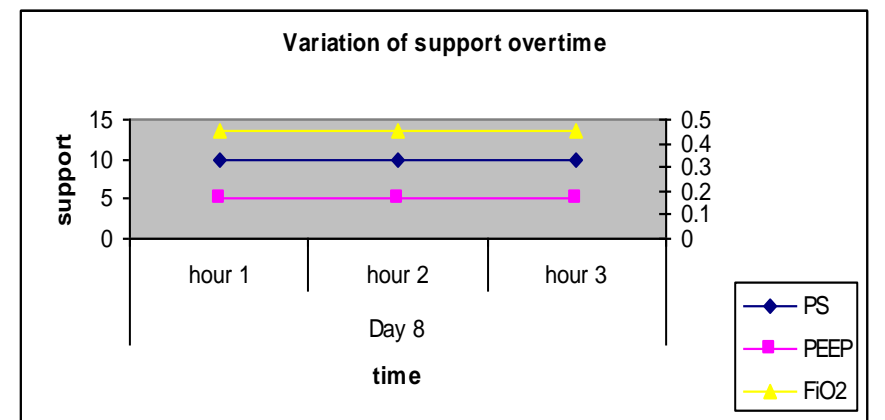
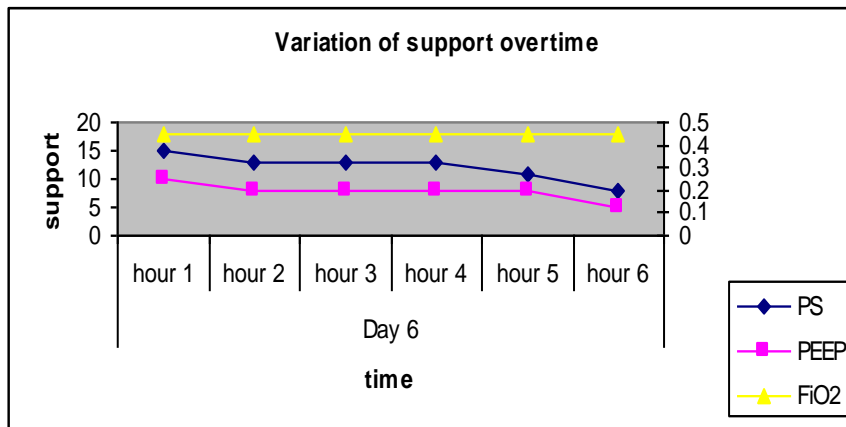
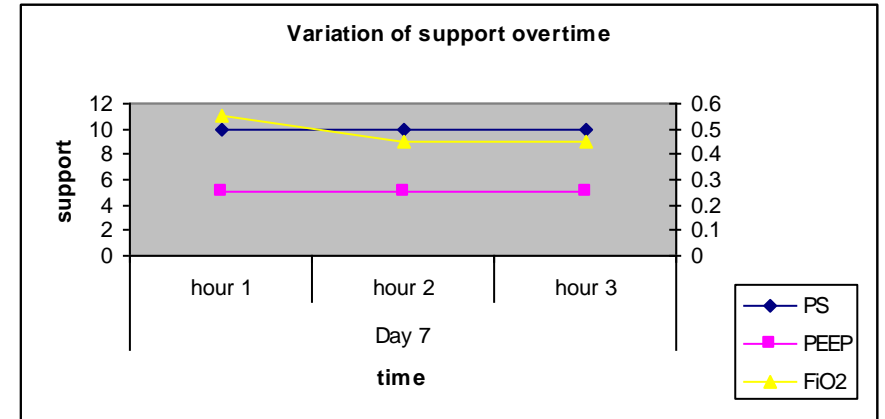
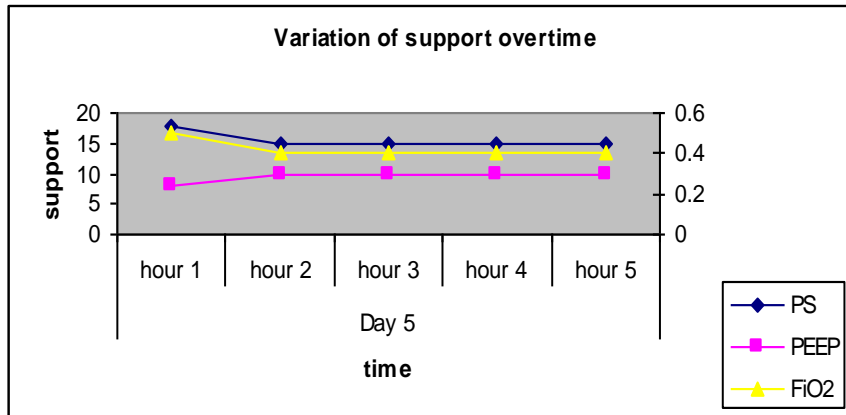
# GRAPHICAL PRESENTATION OF THE WEANING PROCESS OF TWO PATIENTS



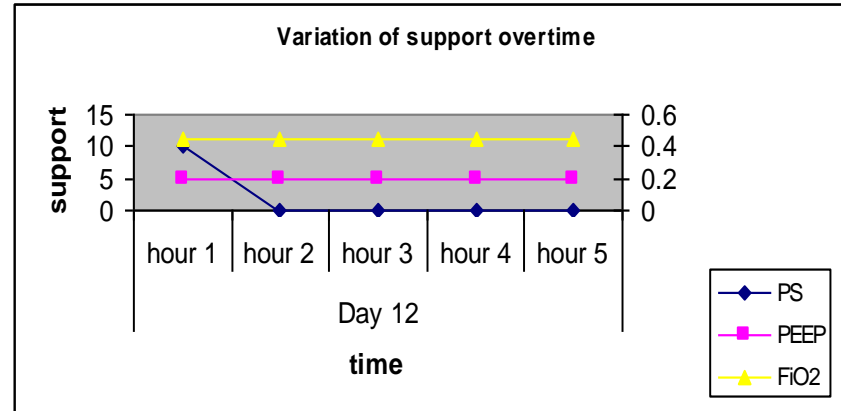
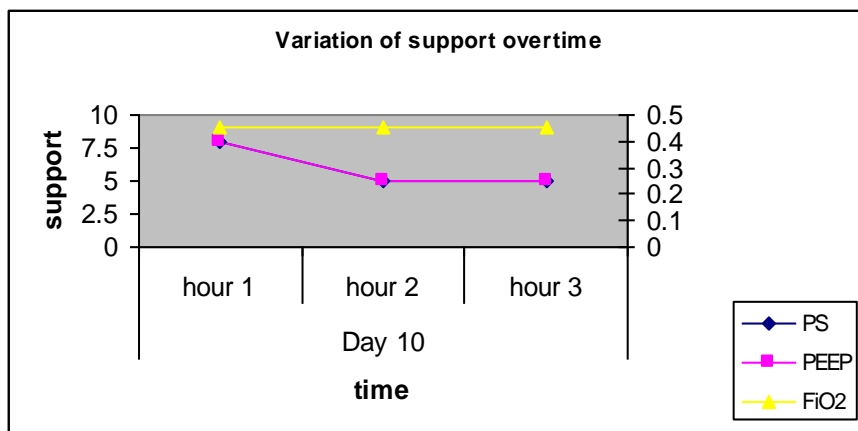
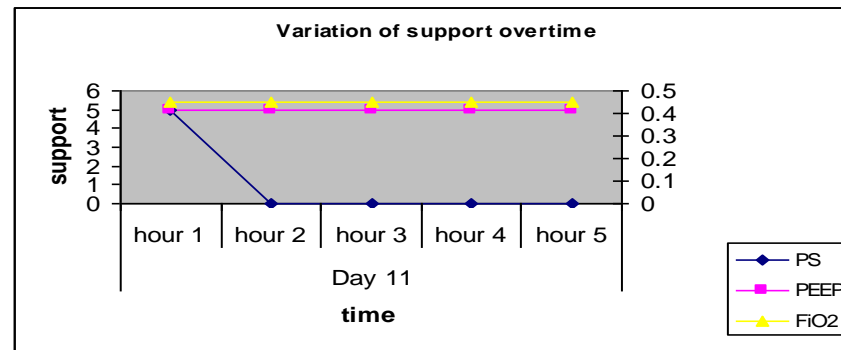
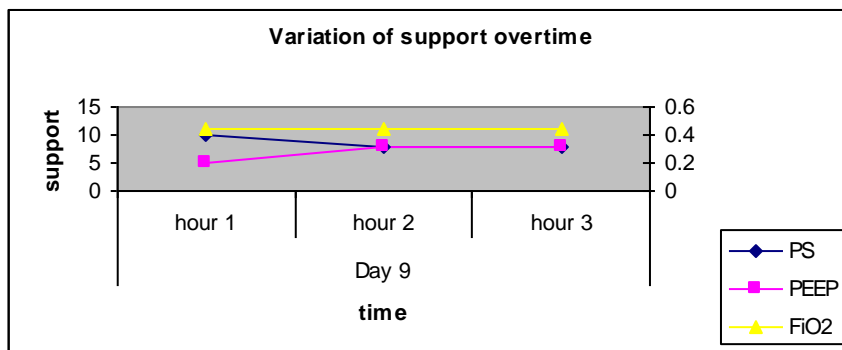
# VARIATION OF VENTILATORY SUPPORT OVERTIME – PATIENT 10



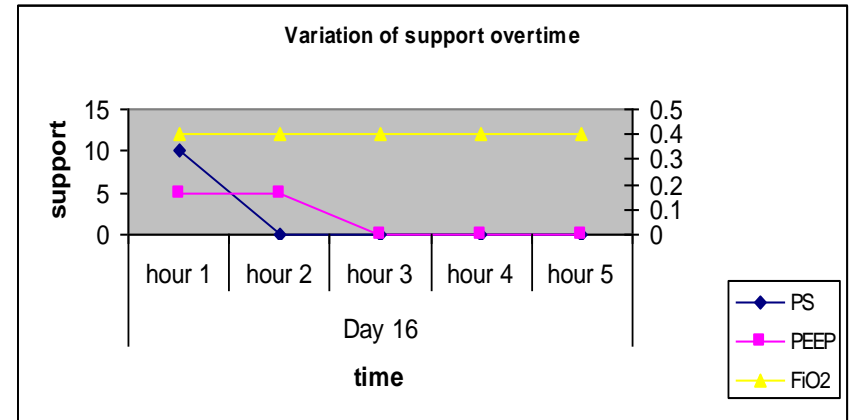
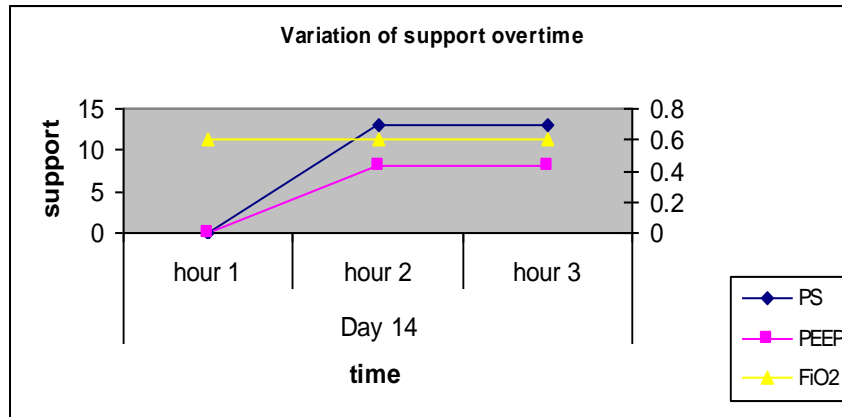
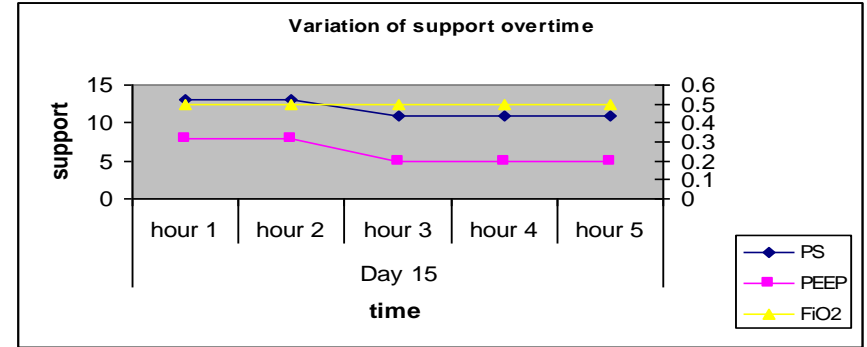
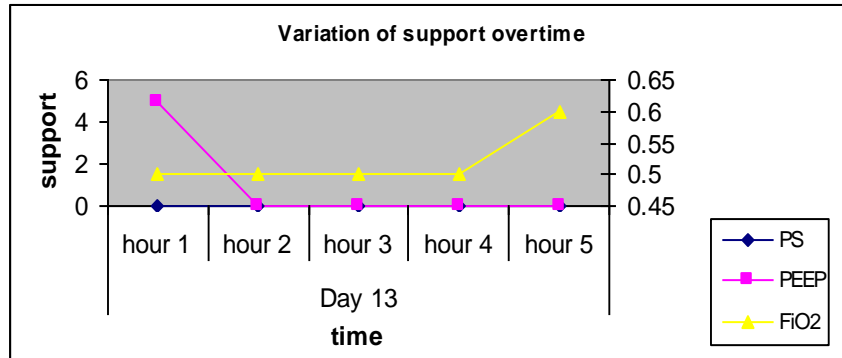
# VARIATION OF VENTILATORY SUPPORT OVERTIME – PATIENT 10



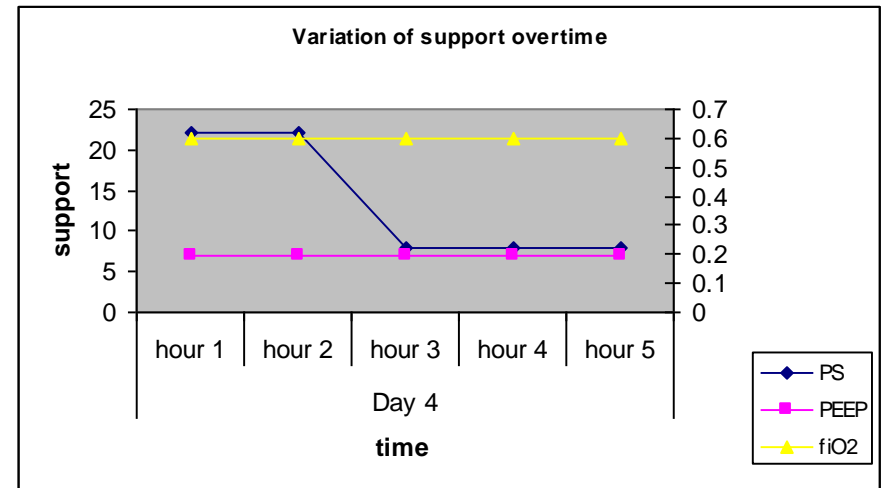
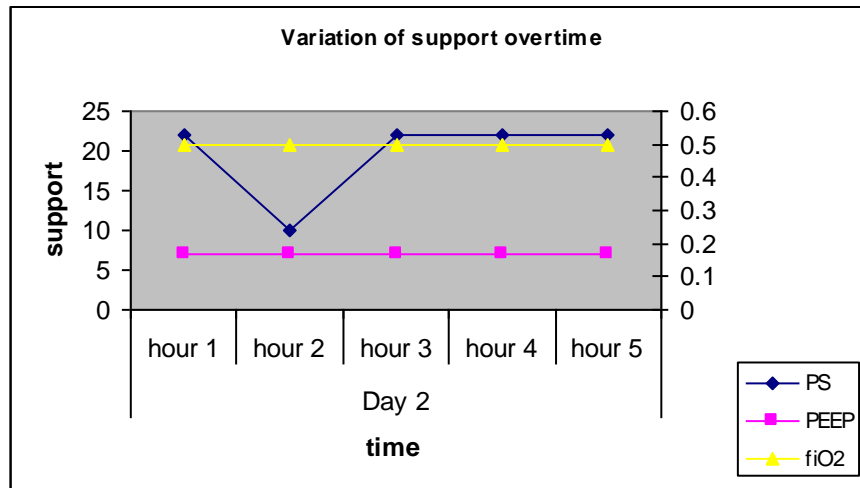
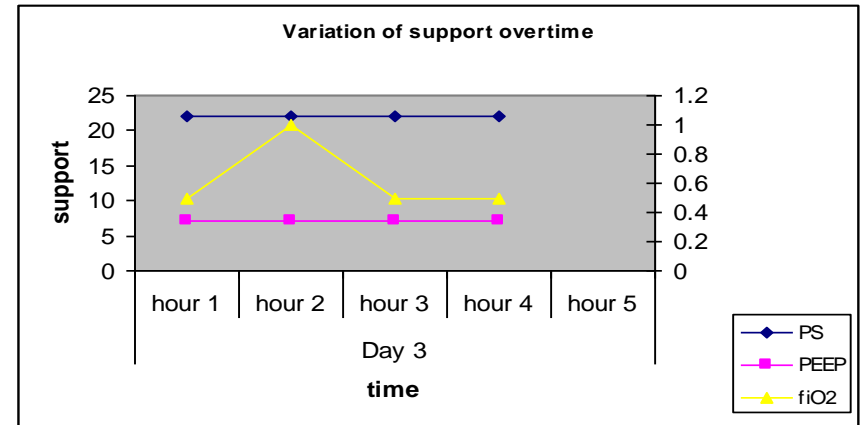
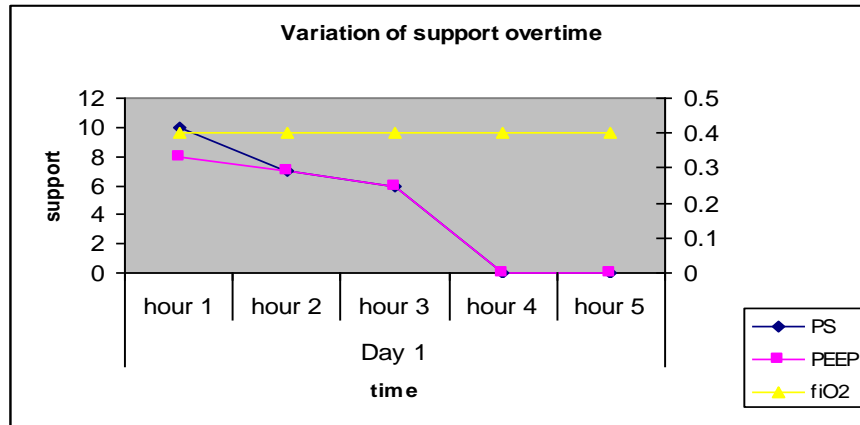
# VARIATION OF VENTILATORY SUPPORT OVERTIME – PATIENT 10



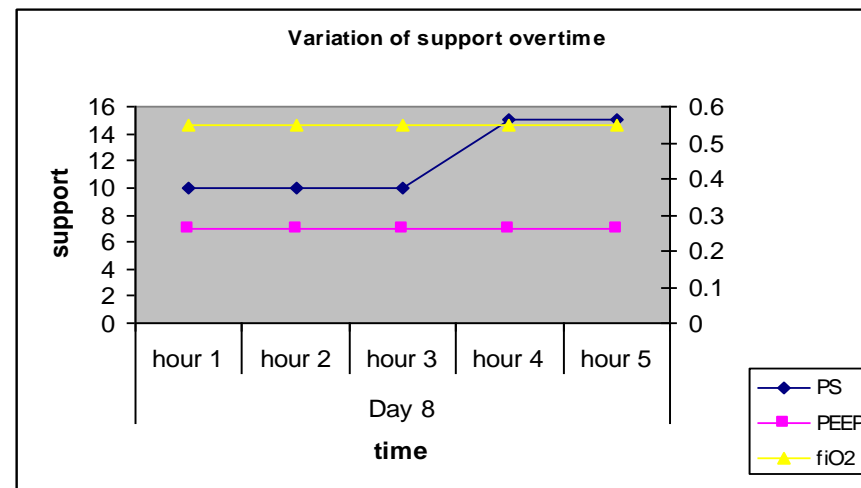
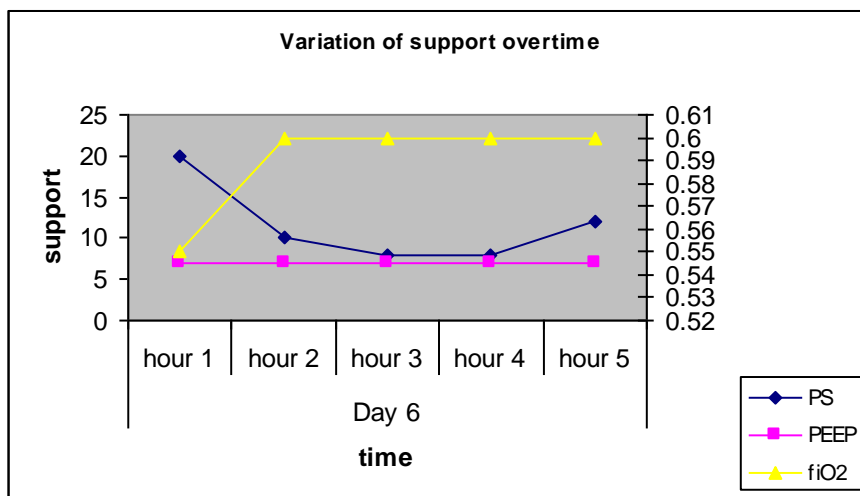
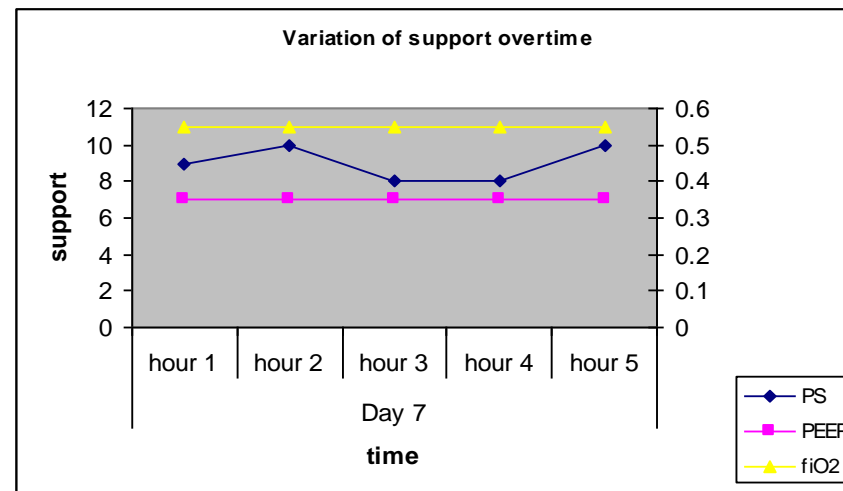
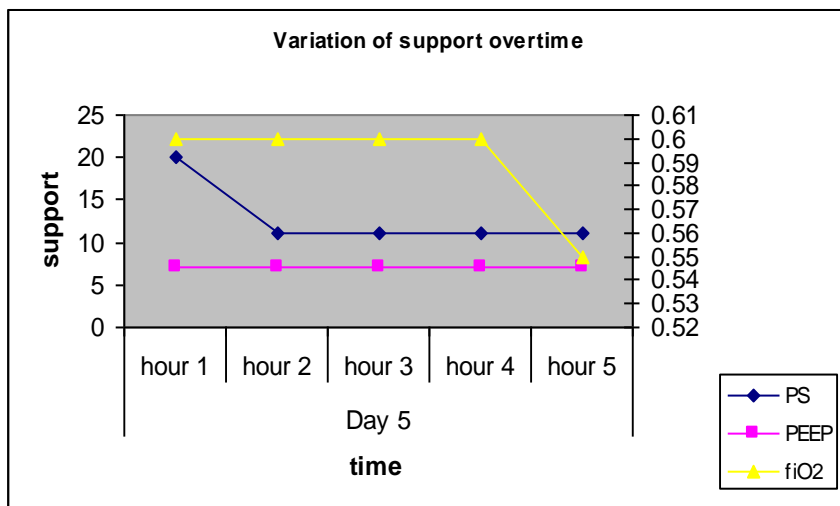
# VARIATION OF VENTILATORY SUPPORT OVERTIME – PATIENT 10



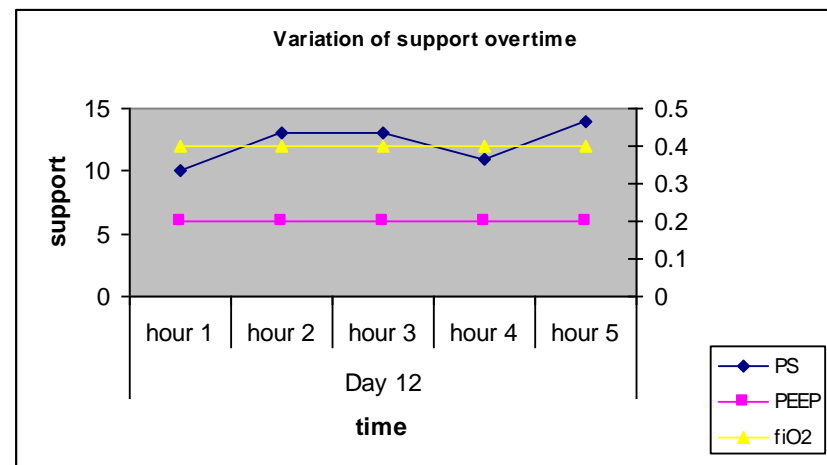
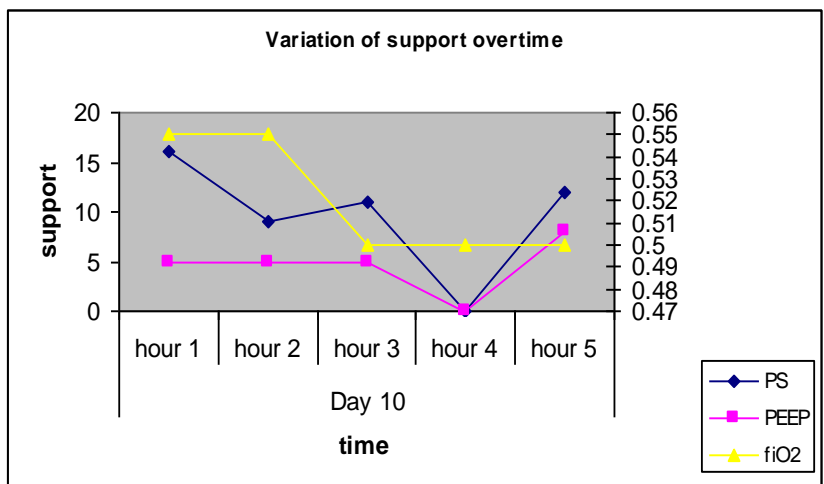
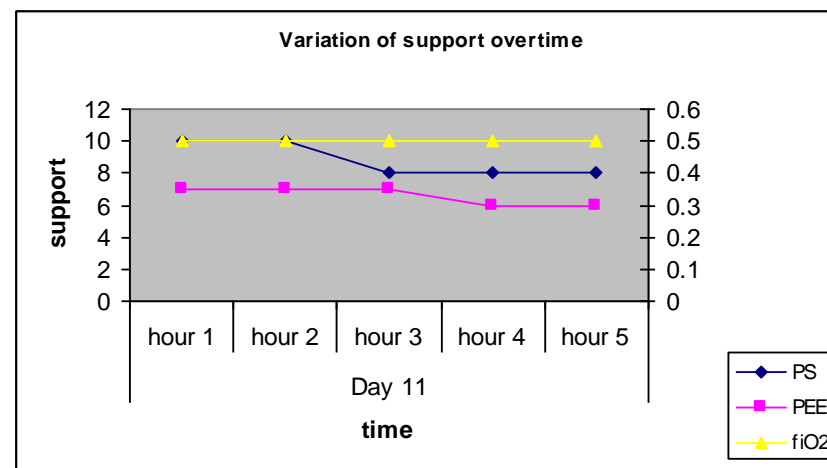
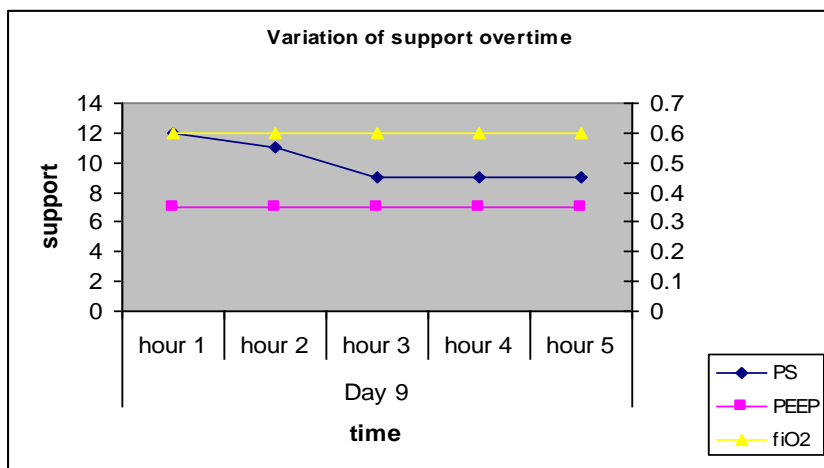
# VARIATION OF VENTILATORY SUPPORT OVERTIME – PATIENT 12



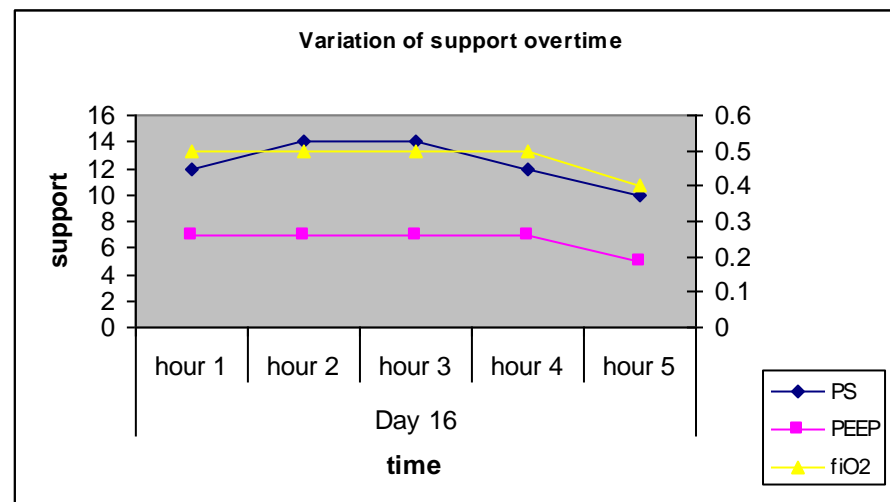
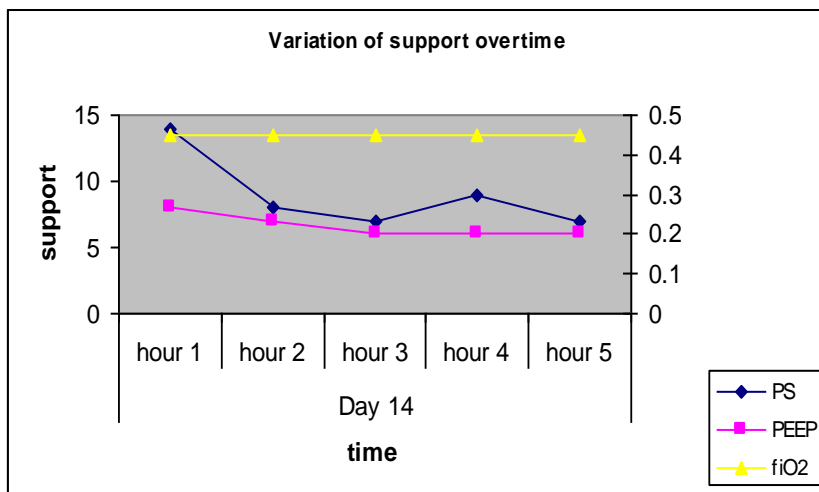
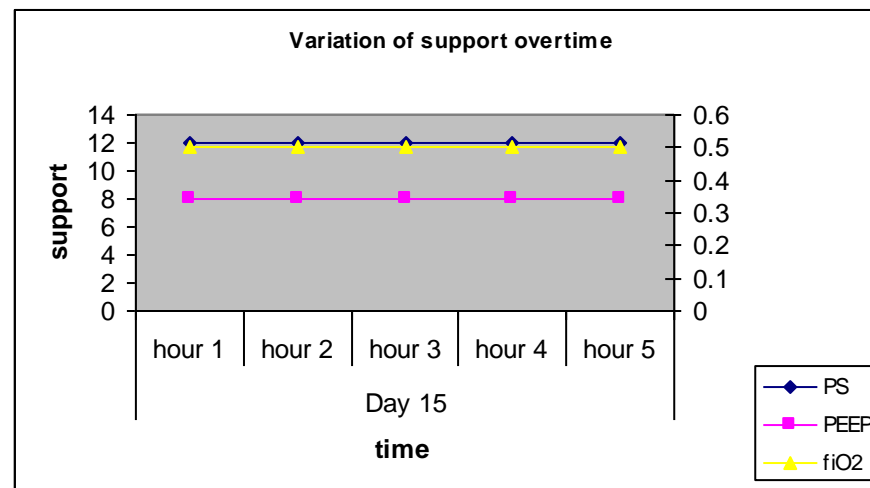
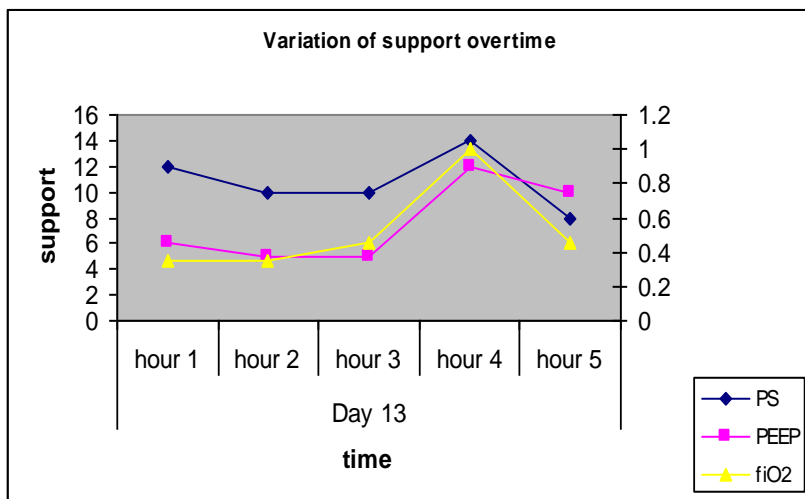
## VARIATION OF VENTILATORY SUPPORT OVERTIME – PATIENT 12



## VARIATION OF VENTILATORY SUPPORT OVERTIME – PATIENT 12

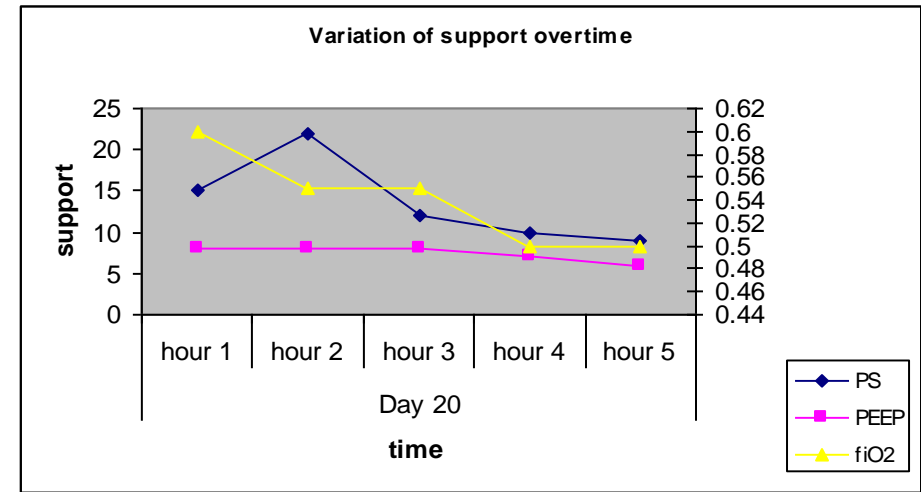
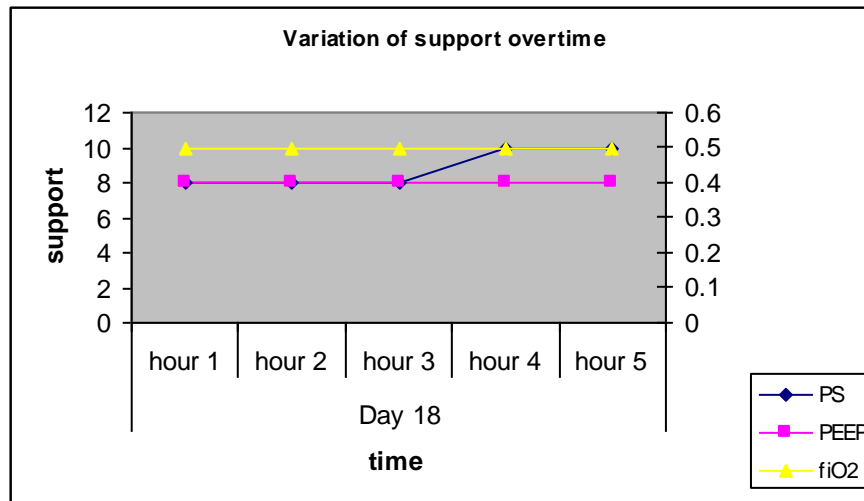
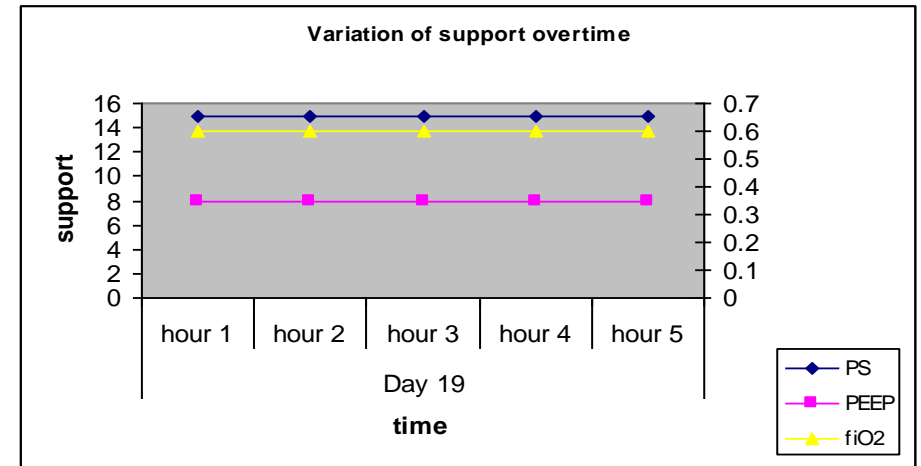
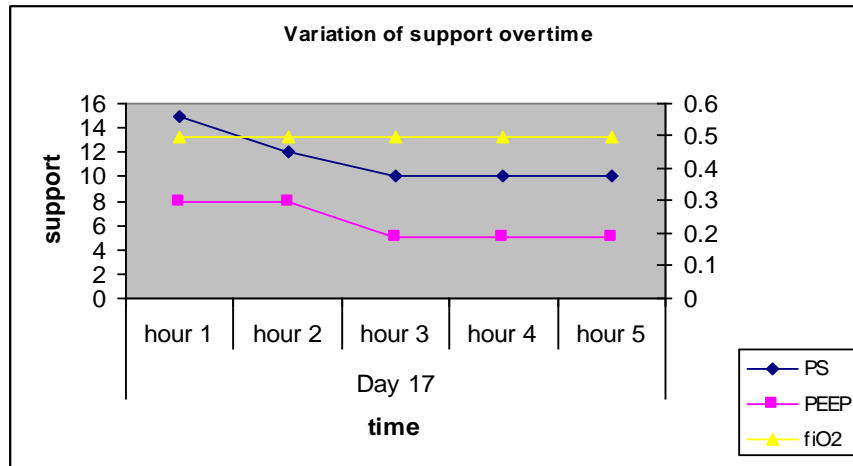


## VARIATION OF VENTILATORY SUPPORT OVERTIME – PATIENT 12

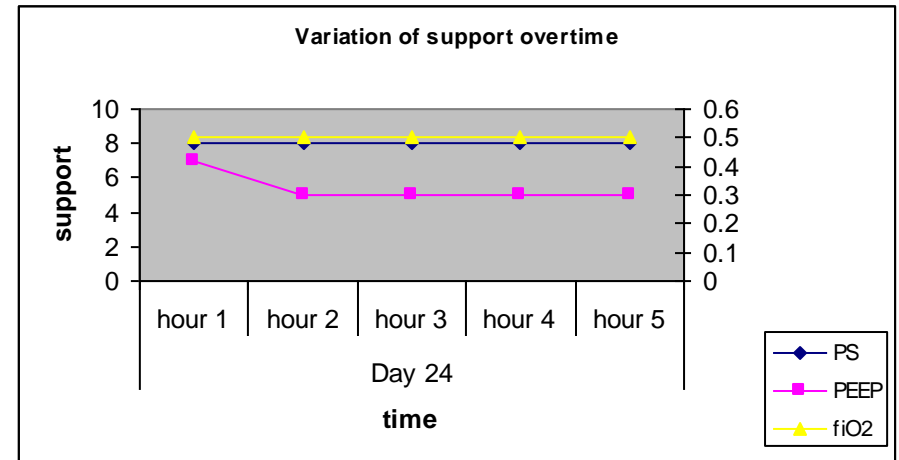
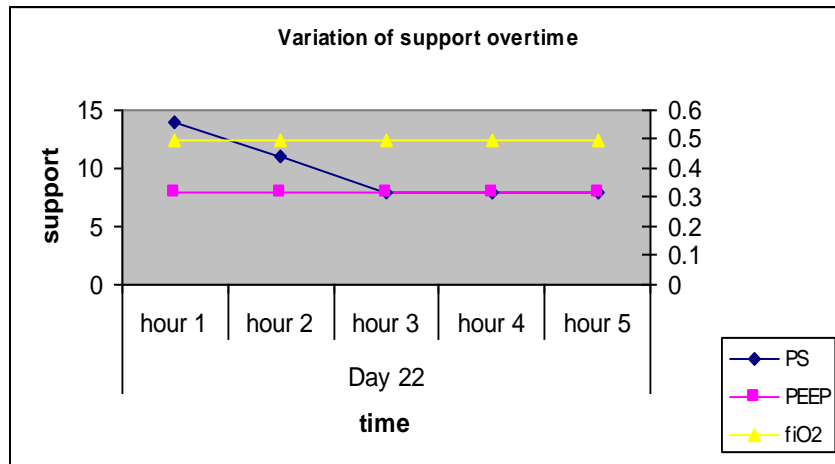
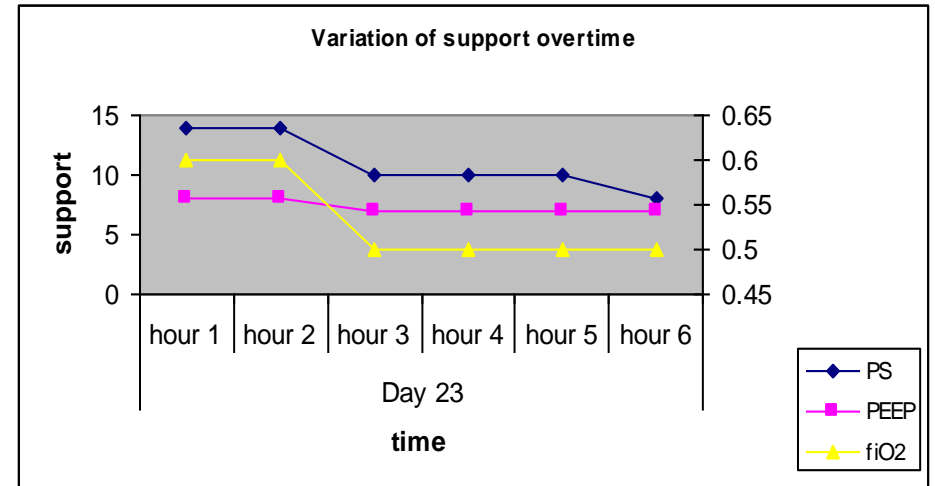
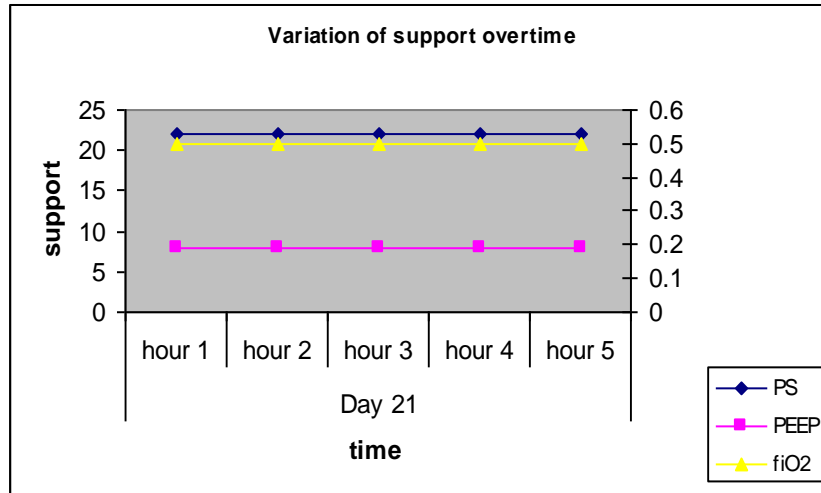




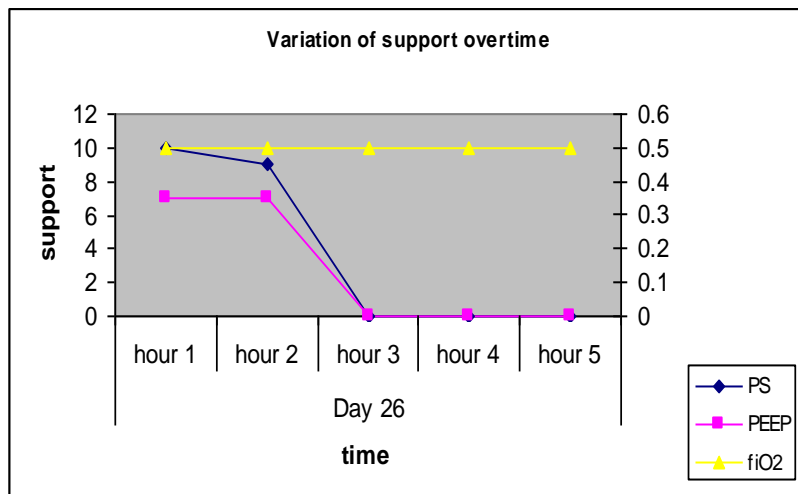
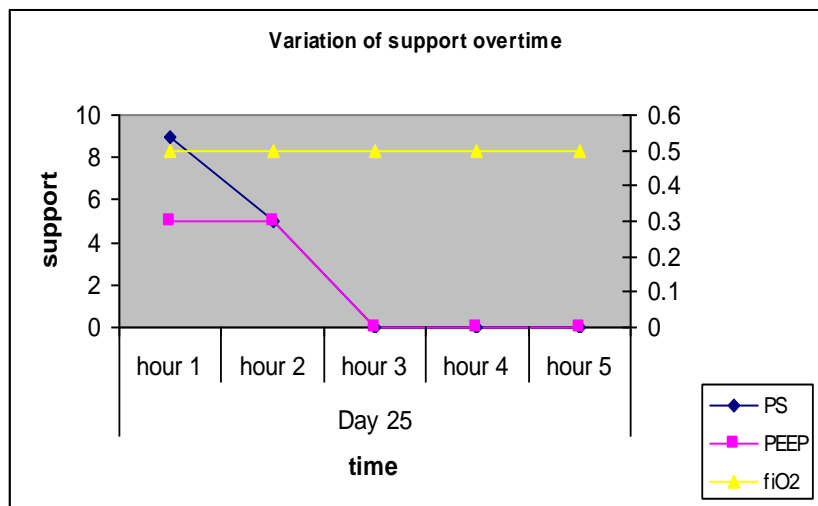
# VARIATION OF VENTILATORY SUPPORT OVERTIME – PATIENT 12



# VARIATION OF VENTILATORY SUPPORT OVERTIME – PATIENT 12



## VARIATION OF VENTILATORY SUPPORT OVERTIME – PATIENT 12



## APPENDIX 7.2 WEANING PATTERNS OF THE SCOTTISH AND GREEK PATIENTS

**Table 7.1 Scottish patients – weaning patterns**

| SCOTTISH SAMPLE | WEANING PATTERNS   |
|-----------------|--|
| PATIENT 1       | <p>Use of BIPAP on pre-weaning phase<br/>           Changed to ASB on day 2<br/>           Gradual reduction of PS<br/>           Plateau PS for many hours and then reduction<br/>           Gradual reduction of PEEP to the level of 5cmH2O<br/>           Adjustment of FiO2 by 0.05 – 0.1<br/>           Early trial of CPAP 5cmH2O on day 3 of weaning resulted in consequent increase of support the following days<br/>           Tracheostomy formation without extubation trial<br/>           Outcome unknown as incomplete observation</p> |
| PATIENT 2       | <p>Use of SIMV on pre-weaning phase<br/>           Changed to ASB on day 5<br/>           Plateau PS for 2 days<br/>           Gradual reduction of PS to the level of 5cmH2O<br/>           Trial of CPAP 5cmH2O and remained overnight<br/>           PEEP reduced to 5cmH2O<br/>           Adjustment of FiO2 by 0.1-0.2<br/>           Extubation</p>  |
| PATIENT 3       | <p>Use of SIMV on pre-weaning phase<br/>           Changed to ASB on day 1<br/>           Plateau PS, PEEP and FiO2 for 2 days<br/>           Gradual reduction of PEEP to the level of 5cmH2O<br/>           Gradual reduction of PS to the level of 8cmH2O<br/>           No change of FiO2, static at 35%<br/>           Extubation</p>   |
| PATIENT 4       | <p>Use of BIPAP on pre-weaning phase<br/>           Changed to ASB on day 11<br/>           Plateau period of PS to the level of 30cmH2O for 15 days<br/>           Gradual reduction of PS to the level of 20cmH2O<br/>           Adjustment of FiO2 by 0.1 – 0.2<br/>           No change of PEEP, remained at level 6cmH2O<br/>           SBT with T-piece<br/>           Tracheostomy formation without extubation trial</p>   |
| PATIENT 5       | <p>Use of BIPAP on pre-weaning phase<br/>           Changed to ASB on day 5<br/>           Plateau period of PS for 3 days<br/>           Abrupt reduction of PS and extubation resulting in re-intubation and tracheostomy formation<br/>           PEEP unchanged at a low level<br/>           Reduction of FiO2 by 0.1 – 0.2<br/>           SBT with T-piece once a day and increase of support overnight<br/>           T-piece all day</p>   |

|            |  |
|------------|--|
| PATIENT 6  | <p>Use of BIPAP on pre-weaning phase</p> <p>Changed to ASB on day 4</p> <p>Failed extubation resulted in re-intubation and tracheostomy formation</p> <p>Gradual reduction of PS</p> <p>SBT with T-piece twice a day with rest period on ASB.</p> <p>Gradual reduction of PS during rest periods. Gradually increasing time for T-piece trials</p> <p>Combination of CPAP 5cmH20 and T-piece trials</p> <p>No change of FiO2 and PEEP, remained on low levels</p>  |
| PATIENT 7  | <p>Use of BIPAP on pre-weaning phase</p> <p>Changed to ASB on day 2</p> <p>Plateau period of PS for 6 days</p> <p>Tracheostomy formation without extubation trial</p> <p>Gradual reduction of PS</p> <p>SBT with T-piece twice a day with rest periods on ASB</p> <p>Increasing periods of SBT and reducing periods of rest</p> <p>Low level of PEEP, remained unchanged</p> <p>Low level of FiO2, remained unchanged</p> <p>Remained on T-piece all day</p>   |
| PATIENT 8  | <p>Use of SIMV for pre-weaning phase</p> <p>Gradual reduction of PS followed by subsequent increase</p> <p>PEEP unchanged at a low level (5cmH20)</p> <p>Adjustment of FiO2 by 0.1 – 0.2</p> <p>Tracheostomy formation without extubation trial</p> <p>Trial of CPAP 5cmH20 on which remained overnight</p> <p>T-piece trial following CPAP 5cmH20</p>   |
| PATIENT 9  | <p>Use of BIPAP on pre-weaning phase</p> <p>Changed to ASB on day 1</p> <p>Gradual reduction of PS to the level 6cmH20</p> <p>Tracheostomy formation without extubation trial</p> <p>Early SBT with T-piece followed by increase of support and no further SBT for 7 days</p> <p>Gradual adjustment of PS</p> <p>Gradual reduction of PEEP to the level of 7cmH20</p> <p>Trial of CPAP 10cmH20 alternating with T-piece for 1 – 3 hours</p> <p>Increased levels of FiO2 while on SBT</p>                         |
| PATIENT 10 | <p>Use of SIMV on pre-weaning phase</p> <p>Changed to ASB on day 1</p> <p>Plateau period of PS for 5 days</p> <p>Gradual reduction of PS to the level of 5cmH20</p> <p>Gradual reduction of PEEP to the level of 5cmH20</p> <p>Trial of CPAP 5cmH20 and extubation, consequent extubation and tracheostomy formation</p> <p>Gradual reduction of PS</p> <p>Trial of CPAP 5cmH20 followed by SBT with T-piece once a day and increase of support overnight</p> <p>T-piece trial all day</p> <p>FiO2 unchanged</p> |

**Table 7.2 Greek patients – weaning patterns**

| <b>GREEK SAMPLE</b> | <b>WEANING PATTERNS</b>  |
|---------------------|--|
| PATIENT 11          | <p>Use of BIPAP on pre-weaning phase</p> <p>Changed to ASB on day 6, then alternating between ASB during the day and BIPAP overnight</p> <p>Failed extubation and tracheostomy formation</p> <p>Gradual reduction of PS to the level of 11cmH20</p> <p>Gradual reduction of PEEP to the level of 5cmH20</p> <p>Early SBT with T-piece resulting in increase of PS and inability for further SBT for 14 days</p> <p>Gradual reduction of PS to the level of 5cmH20</p> <p>Gradual reduction of PEEP to the level of 5cmH20</p> <p>SBT with T-piece once a day and rest periods overnight</p> <p>PEEP fluctuated between 5-7 cmH20</p> <p>Gradual reduction of FiO2 by 10%. Remained at 50%.</p> |
| PATIENT 12          | <p>Use of IPPV and BIPAP on pre-weaning phase</p> <p>Changed to ASB on day 7</p> <p>Gradual reduction of PS to the level of 16cmH20</p> <p>Plateau period of PS at high level more than 20cmH20</p> <p>Tracheostomy formation without extubation trial</p> <p>Gradual reduction of PEEP to the level of 7cmH20</p> <p>FiO2 remained at 45%</p> <p>Mode changed to mandatory</p> <p>Incomplete weaning – patient died</p>   |
| PATIENT 13          | <p>Use of BIPAP on pre-weaning phase</p> <p>Changed to ASB on day 4</p> <p>Gradual reduction of PS to the level of 12cmH20</p> <p>Gradual reduction of PEEP to the level of 7cmH20</p> <p>Reduction of FiO2 by 10%</p> <p>Incomplete observation – patient transferred to another ward</p>   |
| PATIENT 14          | <p>Use of BIPAP on pre-weaning phase</p> <p>Changed to ASB on day 1</p> <p>Early trials of CPAP 5 - 7cmH20 once a day followed by increase of support, starting from the first day of weaning</p> <p>PEEP fluctuated at low level (5 - 7cmH20)</p> <p>Gradual reduction of FiO2</p> <p>Extubation</p>  |
| PATIENT 15          | <p>Use of BIPAP on pre-weaning phase</p> <p>Changed to ASB on day 2</p> <p>Plateau period of PS</p> <p>Tracheostomy formation without trial of extubation</p> <p>Gradual reduction of PS to the level of 10cmH20</p> <p>PEEP unchanged at low level (5cmH20)</p> <p>Adjustment of FiO2 by 5 – 10%</p> <p>SBT with T-piece once a day followed by ASB</p>   |

| GREEK SAMPLE | WEANING PATTERNS   |
|--------------|--|
| PATIENT 16   | Use of IPPV on pre-weaning phase<br>Changed to ASB on day 3<br>Plateau PS and PEEP at 7cmH20 for 1 day<br>Reduction of PS and PEEP to 5cmH20<br>FiO2 changed by 10%<br>Extubation  |
| PATIENT 17   | Use of IPPV and BIPAP on pre-weaning phase<br>Changed to PAV on day 2<br>Alternating between high level of PAV and high level of ASB<br>Abrupt reduction of PS resulting in increase of support to the previous level<br>Plateau period of PS<br>Tracheostomy formation without trial of extubation<br>Gradual reduction of PS<br>Adjustment of FiO2 by 10%<br>Gradual adjustment of PEEP<br>Use of mandatory mode of ventilation<br>Incomplete observation – patient died |
| PATIENT 18   | Use of BIPAP on pre-weaning phase<br>Changed to PAV on day 4<br>Alternating between PAV and ASB<br>Tracheostomy without trial of extubation<br>Gradual reduction of PS<br>SBT with T-piece once a day for 1-2 hours followed by ASB<br>PEEP unchanged at low level (5cmH20)<br>FiO2 unchanged  |
| PATIENT 19   | Use of BIPAP on pre-weaning phase<br>Changed to ASB on day 5<br>Gradual reduction of PS<br>Plateau period of PS<br>Tracheostomy formation without extubation trial<br>CPAP 5cmH20 trial once a day and increase of support overnight<br>SBT with T-piece<br>FiO2 unchanged<br>PEEP unchanged at level 7cmH20   |

## **APPENDIX 7.3 RAW DATA**

### **SECTION A. DIFFERENCES IN CUE ACQUISITION BETWEEN EXPERIENCED AND LESS EXPERIENCE NURSES**

#### **Nurse J (Greece) with <6years/ reduction of PS**

The nurse took a blood gas at 13:10 pm and the results were PH: 7.46, PO<sub>2</sub>: 96.8, PCO<sub>2</sub>: 46. The nurse said that the patient was difficult to wean and did not put her on T-piece because she was becoming tachypnoec and took low Vt. After doing the blood gas and judging from the results, the nurse reduced the PS to 18 from 20 and the PEEP to 6 from 8. I asked her what level she puts for the maximum RR. She said that usually they consider someone tachypnoec when the RR is more than 35bpm because the patient will develop respiratory fatigue. So, she thinks that the patient was not ready to go on T-piece today. She explained that the patient was becoming tachypnoec judging from the respiratory pattern and she increased again the PS to 20 and the PEEP to 8.

#### **Nurse M (Greece) with >6 years experience/ extubation**

The nurse took over the patient with PS: 7 and PEEP: 7. She said that she weaned him to PS: 5 and PEEP: 5 at 10:00 based on his clinical condition and his blood gases. The patient was getting Vt: 450ml and RR: 24bpm and was on FiO<sub>2</sub>: 0.4. His blood gas was PH: 7.54, PO<sub>2</sub>: 91, PCO<sub>2</sub>: 32, HCO<sub>3</sub>: 28, BE: 5.1 and SpO<sub>2</sub>: 98%. The nurse stopped the Ultiva at 11:00. Then the nurse put him on T-piece for 15 minutes to have a trial off the ventilator and observed that the patient had a very good RR: 22bpm, good SpO<sub>2</sub>: 98% and very strong cough. So, she decided to extubate him. After the extubation, the nurse checked a blood gas on FiO<sub>2</sub>: 0.5. It was PH: 7.53, PO<sub>2</sub>: 83, PCO<sub>2</sub>: 35, HCO<sub>3</sub>: 29.5, BE: 6.7, SpO<sub>2</sub>: 97% with RR: 26. I told the nurse that I was afraid he would not manage because of his huge abdomen and his PMH of respiratory failure. She said that he managed fine with his weaning; his abdomen was less distended and had abdominal sounds and started feeding. Now, the patient was coughing a lot, expectorating and swallowing his secretions.

#### **Nurse D (Scotland) < 6 years/ extubation**

Nurse D: Well, I came on and he has been on CPAP since yesterday, since the afternoon yesterday, and his respiratory rate was stable, so I presumed that he was for extubation but he had a bit of a wheeze, so I thought to give him some salbutamol nebs. He was also on propofol at 10ml/h and Alfentanil and he was quite awake, so I thought to leave him on that while he was ready to extubate. So, I didn't take that off. And when the doctor reviewed he wanted him to stay intubated until his wheeze has settled, but then the consultant overheard that so we just extubated him just after 10:30 this morning. Just because his PaO<sub>2</sub> was fine, his volumes his respiratory rate,



everything was settled and he managed on CPAP for a long period of time, he was pyrexial but that was not new, so they didn't see any reason for him to be intubated.

He is day 10 as well and he was still tubed, so either he was going to be extubated or we would have to think about doing a tracheostomy. Obviously didn't seem necessary at all.

CK: So, did he fulfil all the criteria for extubation?

Nurse: Yes, I think he did.

CK: Is that what you thought when you saw him this morning?

Nurse: I thought that he fulfilled all the criteria, because you can deal with a wheeze to be extubated and the sedation was at a level that he was awake enough and it could be easily stopped. He was very awake although he was on propofol that was just to keep the tube in, it was not to keep him asleep, it was just to keep him off pulling the tube out himself. If we didn't take the tube out I think he would have taken it out himself.

CK: Was he very agitated?

Nurse: Yes, he was frustrated with the tube. Nothing much was coming off his chest, just M1, mucoid secretions, small amount. There was no indication that I was going to have a problem with secretions.

#### **Nurse E (Scotland)/ < 6 years/ reduction of PS**

CK: What I would like you to tell me is when you came on the shift and you assessed your patient what did you think of your patient's breathing, what was your plan, what decisions did you make and how did you make those decisions?

Nurse E: When I came on he was on FiO2 0.5, which it had been weaned down overnight. Initially, he has been on 0.6 and he has only been down to 0.5 for a little while, so I knew that the doctors were hopping to extubate him over the next two to three days, so we were just aiming to wean him down as much as possible to see if he will tolerate, although, earlier this morning we didn't know the reason for his poor respiratory function, still we don't know if it is an infection, we've got some preliminary biopsy results but still don't know how he will react to weaning. So, I did pop him down to 0.45 and reduced his pressure support from 20 over 8 to 18 over 8 at about 10:30.

CK: And why was that?

Nurse E: That was following the ward round, and doctors have suggested to try that, so we gave it a go and unfortunately he didn't enjoy it at all, he desaturated a lot, so I got a lot of secretions up. It was at that point that we thought he might have

aspirated, he was desaturating down to 88-89%, it was many yellow, brown, green purulent very liquid secretions that looked more like stomach contents than anything from his lungs. So we had to turn up his pressure support from 18 over 8 to 20 over 8 and his oxygen back up to 0.5 and he settled down with that, he was doing ok. But his FiO2 up to 0.5 was causing his PaCO2 to rise quite considerably, so we did a gas and they weren't very happy, so we had to turn his pressure support up to 23 over 8. Let me see how much it was, I did one at 10:30, and that looked ok, but at 12:00 his PaCO2 was up to 9, so we had to change it accordingly. So I popped that to 23 over 8, left him at 0.5 to settle down for a couple of hours. It was fine then and then just slowly brought it down again to 0.45 and I think I must have changed that again because at that time his family was here and his sats was 98%, everything was really steady. So, he is doing really great at the minute. I said he kept dropping his sats to 89%, and there was nothing, it was only MP1 coming up of his chest, it wasn't helping, I had to give him 100% bolus so many times that I had to switch his oxygen up to 0.5, where he has remained. His pressure support has not changed but I am getting 93% on 0.55, which is not that great. It is probably the lowest it has been today, it's been 94-95%, I had a couple of 98%. He is on a humidified circuit because they felt overnight that the secretions they were getting off his chest were quite thick, which is also another reason why I think that he has aspirated before, because his secretions were quite liquid. So, we popped him on the humidified circuit and the doctors thought that this was a good idea. He just went on that at 15-15:30. It hasn't really encouraged any secretions to come up but we will see how we go. He was getting at the stage that he was getting saline nebs so frequently that it seemed as a waste of time, so we popped him on that. I guess from now until the end of the shift I will try to bring his FiO2 down. I might not go down as far as 0.45 because he seemed that he didn't tolerate that, I will get down to 0.5 and see how we go from there. And then once the doctors come round this evening, we will have some results from his biopsy and we will know what they want to do. To see if they want to carry on weaning or if they want to stay to where we are at the moment, I'm not very sure. I think things will stay as they are for now and see what we do in the morning.

### **Nurse C (Scotland)/ < 6years/ reduction of PS**

Nurse C: When I looked after him yesterday, we had a lot of trouble with the secretions and over the period of the afternoon, so we decided between the physiotherapist and me to put him on the humidified circuit with the view to try to reduce the secretions over the next while. So when I came on this morning we were still getting a lot of secretions off his chest but they were coming up a lot easier. We left him on the same ventilation overnight, so he had been on 0.6 and we reduced it to 0.55 a couple of hours before I came on. They had not changed his support at all, we've put him up to 32 over 12 yesterday, in view of his consolidation, so we haven't changed anything in view of his support at all. I have not been able to reduce his oxygen at all over the day, because of his gases and sats as well. His sats are quite good at the moment, they are sitting at 98% at the moment, they do tend to drop down when we do anything with him particularly with turning. So rather than push things too hard, he is not going to be going anywhere quickly at the moment because

of the state of his lungs, there is no point in pushing too hard on his oxygen and reduce his oxygenation at the moment. We don't have much room to do anything with his ventilation either as far as the support is concerned. So basically, keeping things the same. And certainly when we turned him earlier on, he would start to cough very easily and at that time he dropped his sats down very quickly... not to the extent as yesterday, when he dropped his sats down to 55% , but they still went down to about 80%. And, I had to put him on 100% to bring it back up and he got some boluses of sedation at the same time to make settle his coughing.

#### **Nurse A (Scotland)/ > 6years/ reduction of PS**

Nurse A: When I came, I knew that the patient was intubated with a size 8.5 ET tube and I knew there were reasons that the patient could not tolerate extubation after theatre, so I was aware that the patient had high requirements of oxygen and I was aware that the PEEP was increased over night...

CK: And why was that?

Nurse A: The PEEP was increased overnight because the oxygen demands became so high, she was on 100% oxygen so in order to open up the alveolar pipe for better gas exchange they decided to increase the PEEP from 5 to 10, and that seemed to have an effect because increasing the PEEP allowed to have a reduction in oxygen requirements. So, although her oxygen requirements have dropped they are still quite significant oxygen requirements of 60%. We had an issue of being on 100% yesterday so that was a slight improvement; however, she still had requirement of high oxygen, sats were maintained at about 90-95% when I came on. It was difficult to maintain a decent saturation trace because she was peripherally cool and shut down, so to get a good trace it was difficult, so I relied more on blood gases rather than SpO2 trace. Respiratory rate was very settled ranging to 10-12 bpm, good Tidal Volumes. Pressure Support was reduced to 10 initially but I reduced that to 5 because the patient looks that she is on an ARDS picture, so she will be tolerating lower volumes. So I reduced the pressure support from 10 to 5 a couple of hours after I came on in order to allow for less Tidal Volume if I could but it made no difference to the Tidal Volume at all, she maintained Tidal Volume of 700ml...

So, yes as I say good Tidal Volumes, good minute volumes, saturation you know not a very good trace but it was corresponding with what she has been overnight, you know it was not a decrease. Et CO2 was a bit lower than it was the day before. EtCO2 was about 4.5-5 while it was 3.5 when I came on this morning. Those were my initial findings when I came on.

CK: So, what decisions did you make?

Nurse A: I made the decision to reduce the pressure support so as to reduce the Tidal Volumes, so as not to cause further barotraumas with having the ARDS in the first place and the plan was to reduce the oxygen and wean it as able, obviously with the guidance of the blood gases. So, we were aiming, well the doctors set the parameters

of a PaO<sub>2</sub> of about 9-10 we should aim for, because the lady has a previous history of emphysema and if PaO<sub>2</sub> was higher than 9 or 10 and that would allow me to reduce the oxygen, and that was the plan to reduce the oxygen to about 40% and then start to reduce the PEEP, because the patient is obviously on a high PEEP of 10. So, it seemed a good idea to reduce the oxygen first so that we can have a scope to go up with the oxygen if needed, but also to reduce the PEEP after we get the oxygen to a reasonable level.

CK: So, what would be a reasonable level for her?

Nurse A: I thought about 40% maybe 50%, if you get the oxygen down to there then you know that you have half a reduction than what it was yesterday, so I felt it was reasonable to start reducing the PEEP if the oxygen was down and the PaO<sub>2</sub> was about 9-10kpa.

### **Nurse H (Scotland)/ > 6years/ SBT**

Nurse H: So, when I came this morning he was handed over to be a weaning patient

(The nurse did a funny expression)

CK: Why do you do this?

Nurse H: Because that is how he was described to me, but he was still on 50% oxygen at that time, he was on ASB overnight but that was changed from when I came in...

(The nurse gave the patient a cough, because he was coughing).

Nurse H: It is loose (the secretions), he has a reasonable cough. Can you pass me the stethoscope?

CK: Yes, sure.

Nurse H: Let's have a listen. Ok, comfy? Right. As I was saying the patient has been on 50% oxygen, but he looked as he looks just now, his breathing pattern is the same all day, for several days in a row and a few days on CPAP of 5, he is cooperative, that is the main thing usually, isn't it? He can breathe deeply, he has a reasonable cough and although the secretions are copious they come out easily. He has good air entry, a bit quiet on his bases, due to the infection he had which seems to be improving, it was coming from purulent secretions to mucoid, his white cells have come down, he is afebrile, he had e.coli in his chest which has been treated for a few days now. He appears to be getting better, and he is just on CPAP of 5 with massively big Tidal Volumes, starting to think that he is a candidate for extubation. So, I have put him down to 40% oxygen, his gases are still reasonable, we are not expecting fantastic gases for him since he is a long term COPD patient. I don't think I can think of more. I was reading the weaning criteria which are at the front of the chart, but I am not familiar about using them, I don't know if they have a protocol or

not, but I ticked all the boxes, the criteria are more or less very close thing. The ratio is slightly less than 24, it is 23.9, but as I was saying, the fact that he is able to cooperate with physiotherapist and things, it seems to me that you can provide 40% oxygen to someone who is either on the ventilator or on a mask. He seems fed up, and sick of it (the ET tube) it seems fair to give him a chance. I think it comes down to compassion.

CK: I think he had another window last week of having a chance for extubation, but they were queering of sepsis but they didn't know the source.

Nurse H: Well, yes, but things seem to be improving at the moment, so you can take the risk of reducing the chance to have another infection; so it seems to me a good idea to have the tube out when he has a chance. We should be able to extubate him fairly safely, there is no record of having had a difficult intubation in the first place.

## SECTION B. AGGRESSIVE WEANING BEHAVIOUR BY MEDICAL STAFF

### *Patient 5. Day 4 of observation.*

#### Data from fieldnotes

Looking at the 24-hour observation chart, I saw that the ventilator settings have not been changed since yesterday. The patient was on ASB on 40% oxygen maintaining SpO<sub>2</sub>: 96-97% and on Pressure support 10 over 5 until 11:00, maintaining respiratory rate 26bpm and Vt: 460-500ml.

The doctor's plan after his assessment was to change the ventilation from ASB to CPAP and to stop the sedation completely until extubation.

So, the nurse stopped the sedation at 9:00. After 11:00, the nurse changed the settings to CPAP with PEEP: 5 and did a blood gas at 11:30.

The nurse commented that the patient had copious muco-purulent secretions, that he had a reasonable cough and that on auscultation there were crackles audible; therefore, the patient needed physiotherapy before extubation. The nurse was reluctant to act upon the medical instruction to extubate the patient.

Moreover, the physiotherapist reviewed the patient in the morning and reported that the patient is calm and quiet. His chest sounded wheeze and quiet bibasally. Therefore, the physiotherapist hand bagged the patient and suctioned him yielding muco-purulent secretions three times. The patient's chest sounded better after physiotherapy.

At the ward round, the doctor again presented the patient to the rest of the team who decided to give him a trial of extubation, with the view that if he fails they will do a tracheostomy. So, the nurse extubated the patient.

The nurse observed the patient and commented that he looked as if he could not expectorate. His cough was very weak and he was retaining his secretions. He kept removing the mask and did not look comfortable at all. He was agitated and his SpO2 dropped to 93%.

The nurse mentioned all these changes to the medical staff and they decided to re-intubate the patient electively and do a tracheostomy, because of the amount of secretions in his chest. In the afternoon, the patient had a tracheostomy.

### *Patient 12. Day 2 of observation*

#### Data from fieldnotes

The nurse observed the patient. The patient was ventilated on PS 14 and PEEP: 8 on FiO2: 0.6 until 10:00 in the morning, and he was getting Vt: 369ml, RR: 20bpm and SpO2: 95%. The nurse checked a blood gas at 10:00, which showed that PaO2 was 96mmHg and PaCO2 was 46mmHg.

At 11:00, the doctor reduced the FiO2 to 0.5 and the PS to 10cmH2O and PEEP to 7cmH2O for 3h. At 14:00, the doctor reduced the PS even more to 8cmH2O and the PEEP remained at 7cmH2O. The nurse observed the patient, who was getting Vt: 500ml and RR: 27bpm. The nurse repeated a blood gas, which showed PaO2: 110 and PaCO2: 53.

The patient remained on PS 8 and PEEP: 7 and FiO2 0.5 for the rest of the day. The nurse reported that he was getting Vt: 420ml and RR: 26, but judging from observation of respiratory pattern it looked as if he was becoming more tired, because the Vt reduced to 290ml and the RR increased to 30bpm. The nurse checked a blood gas, which showed a reduced PaO2 of 68mmHg and PaCO2 of 61mmHg. The nurse said that the result from the blood gases showed the fatigue in his breathing. However, no action was taken at that time.

...Later, the nurse checked another blood gas which was not very good. PaO2 was 48 and PaCO2 was 53 and SpO2 was 85%. The nurse said that the patient was getting Vt: 300ml and RR: 29bpm. The nurse explained that the patient was anxious and that he wasn't able to sleep. He had Xanax and Seroquel and when the drugs started acting he dropped the SpO2. I asked why that happened and she replied it was because he had a lot of secretions...

### *Patient 12. Day 4 of observation*

#### Data from fieldnotes

Today, the patient was on PS of 9cmH2O and PEEP of 5cmH2O in the morning, which the doctor weaned to 5cmH2O. The nurse checked a blood gas, which showed

PaO<sub>2</sub> of 62mmHg and PaCO<sub>2</sub> of 52mmHg and SpO<sub>2</sub>: 92%. At 10:30 the patient was sitting on his chair and was looking comfortable. His wife was there.

Although the blood gases were not acceptable, the doctor decided to attempt a SBT, so the nurse put the Swedish nose on 14lt. The nurse observed the RR, which was 39bpm. The nurse asked the patient if he felt comfortable with his breathing and reassured him about his breathing. She asked him to breathe normally. The nurse mobilised the patient, who stood up and then sat on the chair.

At 12:10 the patient was still on the Swedish nose, so that was already 2 hours without any positive pressure support. He was hypertensive with BP: 192/85 and HR: 101 and RR: 25 and SpO<sub>2</sub>: 97%. The patient asked the nurse to suction him.

At 13:00 one of the senior doctors put the patient on the speaking valve and deflated the cuff. He connected a tracheostomy mask as well so that he can take oxygen. He explained to the patient that he can talk now. The doctor said that his breathing pattern was looking good.

The nurse checked a blood gas after half an hour, which showed a PaO<sub>2</sub> of 80.9mmHg and PaCO<sub>2</sub> of 63.9mmHg. The nurse noticed that his PaCO<sub>2</sub> has increased slightly but that was due to the use of the speaking valve. She mentioned it to the doctor who said that it was something expected. At the ward round, at 14:00, the doctor presented the patient to the rest of the medical. They were satisfied with the patient's progress and did not make any other recommendation or plan.

The patient continued to self-ventilate with the speaking valve until 18:00 in the afternoon, so that was 8 hours without any positive pressure support. He was moved to his bed but he dropped his SpO<sub>2</sub> to 82% and the nurse checked a blood gas, which showed that PaO<sub>2</sub> was 67mmHg and PaCO<sub>2</sub> was 67mmHg. The nurse commented that 8 hours without any support was too much for the patient to sustain and then went to inform the doctor. The doctor then put the patient back on the ventilator on PS 10 and PEEP 7. The nurse observed that the patient was taking Vt: 250ml and RR: 29bpm. The patient remained on PS 10 and PEEP 7 for the rest of the day. He was also on FiO<sub>2</sub>: 0.5 maintaining SpO<sub>2</sub>: 97%. The nurse checked another blood gas at 22:00, which showed PaO<sub>2</sub> of 89mmHg and PaCO<sub>2</sub> of 48mmHg. The nurse observed that the patient was taking Vt: 370ml and RR: 27bpm.

### *Interview with nurse Louise - Scotland*

CK: Can you remember an example that you disagreed with the doctor?

Louise: On weaning somebody? Some consultants will turn ventilation down hugely, I mean not kind of incrementally stage by stage, they will just whack the ASB right down and then walk away. And that is the way they do it. And then you are left to sort all out...whereas mostly, as with the rest of the staff here, they will gently, gently kind of reduce things stage by stage. I suppose some people will wake up more quickly and will need to be extubated very quickly, so you can just turn down

things very quickly and go for it, but there are doctors who will do things differently than others. They are more aggressive.

### *Interview with nurse Pinelopi – Greek ICU*

Pinelopi: The doctors... (laugh). Ok, now...yes...yes, generally, yes, they wean effectively. There are others who wean fast. They want to wake up the patient tonight so as to show a progress of the patient during their shift, tomorrow morning. You know, that they have woken the patient up and they have done something.

### SECTION C. LACK OF FORMAL TRAINING

### *Interview with Doctor Christina – Greek ICU*

CK: Who makes the decisions about the ventilator changes?

Dr Christina: The doctor. Exclusively. The nurse can suggest though. Experienced nurses can suggest, they can say that this patient is waking up and looks good, shall we continue?

CK: So, the nurse cannot take the initiative to reduce the support etc.

Dr Christina: No, no.

CK: Why is that?

Dr Christina: It is a medical action, the nurse cannot do it, she can suggest especially when she has the knowledge. She is not educated from her basic studies, she does not have the knowledge to do it. She can obtain that knowledge here from lectures that we give and we can discuss things. You will see there are many nurses, because they are not all the same, who are interested in learning everything. There are nurses who can do that. What they can obviously do is the opposite. To increase or even reduce the breaths. They can do that even if the patient is not weaning. It depends, because they check the blood gases and if they see that the patient had high PaCO<sub>2</sub> or they will reduce the breaths on a mandatory model of ventilation. They know how to do that.

CK: So they cannot wean because of their lack of education.

Dr Christina: Yes. Chara who is the physiotherapist and is very competent in weaning, she can do it. Sometimes she might not feel very certain about something and she will ask. She might not do it herself but she will ask first...I think it is a matter of education. Nurses who work in intensive care, I do not know how their system works. They are not trained to work in intensive care. They are offered the job, they come in intensive care and they are trained in one month until they start taking over a patient themselves.



### *Fieldnotes and discussion with nurse Vivi – Greek ICU*

Vivi referred to the lack of education regarding weaning and the ventilators. She said that when she started working in the unit no one showed her how to use the ventilator. She learned with her own initiative to read the bibliography, and asked questions. When she started working, the charge nurse had no idea about the ventilators. Later on, when other nurses started working in this ICU, most of them learned how to use a ventilator because one of the nurses was kind enough and willing to show them how to use it. But that depended on how willing the person was. There was no support from the educational coordinator. This is something that started being organized recently.

### *Interview with nurse Stella – Greek ICU*

CK: As an experienced nurse, do you think that you influence the patient care?

Stella: Nurses in ICU are very powerful, but they don't know it. Only our medical director is aware of that. I believe that nurses in our ICU lack education. They have empirical knowledge because of their experience, but they lack of continuous development, which makes them be afraid.

### *Interview with nurse Angela – Greek ICU*

CK: Can you change the settings on the ventilator?

Angela: It is better if we don't do that.

CK: Why is that?

Angela: We are not competent in using the ventilators. There is no such a module during our education, there is no such a course that you learn the basic use of ventilators. If you want to learn something more you can, if you don't want to then you will never learn it. During the specialization course we learn many things about the ventilators. For example, I have not done my specialization yet, because I am less than two years in ICU, but I can do things empirically. If the patient's blood gases are not good then you will do something. And then you will inform the doctor, you will say that this is what I did, are you ok with that? Or if it is a night shift and the doctor is resting, or if he is busy with other patients you inform him. However, we can't make changes of the trigger or the tidal volume. We can change the respiratory rate based on the PaCO<sub>2</sub> or the FiO<sub>2</sub> based on the PaO<sub>2</sub>. You can play with these.

### *Interview with nurse Gordon – Scottish ICU*

Gordon: I think we need to empower nurses at the bedside to be able to comfortably go ahead and do that.

CK: How?

Gordon: And it is fine to say they meet all these criteria, but where do you go when you are on pressure support 15 and PEEP of 5. You need something to prompt them to say where do we go from here? We need to wean them back to CPAP before we extubate them and how far do you go to wean your pressure support. It was quite gradual to reduce it by 2mmHg, but sometimes people would turn that down quite considerably to 10 over 5, you know...

CK: You mean the doctors?

Gordon: The doctors would probably do that, yeah. I don't see why it cannot be a nursing thing. I think if we can empower them to do it safely, then why not?

CK: How could we do that, you think?

Gordon: I think algorithms are a way to forward nurses' support. I think as a senior nurse I would be happy to wean somebody to reduce the pressure support and probably not as cautiously as 2cmH<sub>2</sub>O every half hour. I would push them a bit harder if I thought they were right. But I think for junior members of staff it is about providing education, empowering them to follow a safe protocol, an algorithm to feel confident to do it.

### *Interview with nurse Yvonne – Scottish ICU*

Yvonne: Education and experience I think are the polar and only the two ways that you can improve decision-making. Possibly more lectures from the physios and more talks by the physios why positioning is important, why suctioning is important, why bagging is important, or that sort of thing. Junior members of staff being supported by more experienced people. Maybe doing case studies, maybe sort of educational cases of why we do certain things may help junior staff come along a lot quicker. Because I think a lot of them get stuck with long-term weaning patient but they don't know how to wean a long-term ventilated patient. And that is a skill, to be able to do that. Normally, what you are going to change is part of more education and more input by the doctors, the physios and everyone else who is involved in it.

## SECTION D. LACK OF LEADERSHIP/ SUPPORT

### *Interview with doctor George – Greek ICU*

Dr George: Yes. You burn out in a job. When you are so many years in this job and you do not like it, you burn out. We also burn out, although we are more motivated. But we get out of the unit, we do different things, we keep our interest. The nurse does the same things every day, for so many years. It is difficult to find a motive.

CK: So, what do you think should be done to improve this situation?

Dr: The biggest problem is this. That they do not have a motive and they burn out. Nurses should not work 15 years in intensive care. They should work for 3-4 years, go to work in another clinical area for 6 months or so, and then come back. They should rotate. We are not here all the time, we go out for a week every month; we do not deal with patients during that week. We have a reason we do that. Intensive care is a difficult environment, and nurses should do the same. 5 years in the unit is the maximum period to work in intensive care, the American literature supports. 5-6 years maximum. And one year somewhere else. They should have the opportunity to do a postgraduate degree, to have other motives as well. To go somewhere else and experience different things. To be involved in papers and studies. Not to have the same routine every day. I can understand why they do not have a motive. However, there are people who are passionate for their job and they do it perfect. They just need a good leader to support them.

### *Interview with nurse Maria – Greek ICU*

Maria: I have met the Nursing Director and have complained that we are very busy.

CK: So, what did the Nursing Director say in that case?

Maria: Well I went there to ask for changing a placement, and I told her that I am very tired...what could she say, really? That she understands, and that they care about us, they try to change things and we work on these problems. She even promised me to change my placement, but she said that she couldn't do it immediately, because it was July and it was tight with the annual leaves and said that she would do it in September....yes, note that that was September 2004. I'm still waiting for that September to come! Or has it already come and I haven't realized? I don't know. She sounded very positive with what I have told her, she said that she understood my problem...she was just pulling the leg. Then I went again to meet the Manager, and she laughed at me. I didn't know how to react. I thought that she was laughing at me. She said that she understood my problem, so I asked her what to do. She told me to put on a claim. I told her that I have already done that, and she told me to do another one. And I said... 'Then what?' She said to direct the claim to the Nursing Director and I explained to her that I have already done that. So, she said, go to your unit and

wait... They do not care. For example, they say that they can't change my placement now because there are other people more senior, but when a senior nurse speaks to them and is taken under consideration, and you have the illusion that your complain will be heard as well, it is important. But it doesn't happen.

...They do not support us at all, and I will tell you why. It starts from the manager and the nursing director. They, themselves feel deficient in knowledge. When they introduced the postgraduate programs, they had to decide who was going to register, but most of them did not even have the proper qualifications to apply. And when you see a 20-25 year old junior nurse willing to learn, you can't take for it. Many times they have rejected people's applications for study leaves, they don't give them the opportunities...and those nurses have to suffer. There is no progress on that field at all. Even for a seminar, or a conference, there are people who had to take their annual leave to go... Once they tried to encourage us to do studies. But how? When I want to do a study and I have a very busy off duty and you don't give me time off...ok, I want to do it, but I also have a life...you see? And if I have some free time I will spend it with my children and my husband, with my family, not on the study. No matter how bad that sounds...

... No, they are not supportive at all. When you complain they would say that they try to change things but they don't do anything. And this is very tiring, very frustrating. Our psychology is so fragile and it can change all the time. You can't observe that when you are sitting on your chair in your nice office, you can't understand how fragile the balance is. You realize that when the unit is very busy continuously, and there is tension between us.

### *Interview with nurse Sofia – Greek ICU*

Sofia: Interpersonal relationships are a bit tense in this unit for many reasons. Every new person who comes to work in this unit, like me that I am new, I came with the best willingness and motivation and challenge to work and help the others. But you see that they cut you off, or you do not find support when you need a hand, only one or two people will help you and then you will only help those two people...

### *Interview with doctor Alistair – Scottish ICU*

CK: How could we improve nurses' decision-making during the weaning process?

Dr Alistair: A lot of that is a culture thing. In the institutional medicine, it is that doctors make the decisions. I think ITU is very bad with that, because you have a very large medical team...I would say we have a high dependency and intensive care together, we work both. The high dependency has less doctors and nurses need to look after the patient while the doctors are not there, and therefore they have to learn to make decisions to some extent, whereas in intensive care they are not forced so

much to make decisions, there is always someone else you can ask. So, it is making a culture of decision-making.

But also, the other thing is that they have to be supported, because there is no point in training nurses to make more decisions if when they make these decisions, they are not backed up by the medical staff. Because the decisions might not always be right, just because when you follow what it would be the right thing to do, sometimes patients don't do well and in these situations everyone makes mistakes. So you have a situation when the nurses are encouraged to make decisions and they are not criticized for them. So culture changes the dynamics between doctors and nurses as well. But I think it is very important to have this culture to improve, because we are in a situation when the doctors are more inexperienced and less able to make those decisions. So, relying on junior doctors who change every 4 months to make those decisions is crazy. In four months that they might see very few difficult to wean patients, and a lot of intensive care is not about the sort of knowledge you get in medical school, it is experience of looking after some sort of patients. You have to encourage the more experienced to use their experience to make decisions. And support the fact that they make decisions and not override them all the time. I suppose if the consultant is on and you have a nurse who is keen to make decisions and you don't quite agree in that is how you do it, then it is wrong to say that this is how we do it because this is the way I do it. You say ok try that this way and see, ok if something is not dangerous. But you need to let, if you want people to learn how to make decisions you need to allow them to make them. And you have to give them time and space to do that. So I think this is how the culture of the unit is. The main thing about intensive care within Scotland is that in different places you will find the culture is different, everywhere you go...

...Team is difficult in this unit because it is one of the main issues. The team is very enlarged and they often have these inexperienced nurse looking after very large number of patients. And actually the way that more junior nurses learn is by having contact with senior people looking after them. I think that team doesn't work very well here. I often wonder if that things have been discussed, but I think that if you had more senior nurse doubled up with more junior nurse, there is, you would know if that nurse had any questions and that you would have the senior nurse overlooking the patient; then you get more dialogue between them, and formalize that with someone more senior, not an official teacher...

...The thing is that...like M&M meetings will come to this too, is that if you have 18 ventilated patients with lines and ventilators, there will be coincidence and you have to look at them critically, but you have to have a culture where people are allowed to make mistakes and be discussed about in a non-hostile and critical environment. That's one of the worst things in this ICU, that they are too critical about people making mistakes. And if you have that kind of culture then people start to practice nursing and medicine defensively. I'll just ask the doctor and it is not my problem, it is not me to blame. That's the bad culture. You have to...some nurses said that they do not like going to the M&M meeting because it is not time realistic, and that is entirely true. And that's not the way to have a good and efficient system. People

feel...you have to feel protected, that people will back you up for making decisions. And I'm not sure that that's very good here.

### *Interview with nurse James – Scottish ICU*

James: I think the rotation of the doctors makes teamwork a bit difficult, because you are not even close to guarantee the same people on a regular basis. The doctors change every three months, physios every two or four, the junior doctors, so you are not getting a consistency from that point of view. Equally, the way our rota is worked, the pattern of every team may not see the same doctor for 6, 8 weeks at the time, so it could be a different person every day. The way our team has worked, as nurses we are generally working with the same group of people, if they do a night then we do, so you get to know your own team and as long as that team works, then it is quite good. If it doesn't then you are stuck with the same bad team, unfortunately with mine. And this is a job for our charge nurses or team leaders to sort out. Again on call services with physios...this weekend we had two guys who have not been here for months, so they didn't know any of the patient, or what the scenario is. So more consistency would be good from that perspective, for the long-term patients with complex needs.

### *Interview with nurse Rebecca – Scottish ICU*

Rebecca: Communication. Yes, I think it has to be communication. Being honest, you know talking through plans, plan for the unit, plans for the future, you know like the senior staff nurses have, have F and G's meetings, have meetings with the consultants, make sure that the information that they get is always discussed goes further down to more junior staff. Just involving everybody in the major decision-making. Because I think when everybody feels involved then they trust us, it is highlighted, you know you feel like you are member of the team as opposed to somebody who comes and just does the job pr what they are told. I have never felt, initially when you get over the routine, because it is a really strict routine in this ward, but once you get into the way of it and it does become routine to you as well, then you do feel like you have a role, and that role is important. And I think, I can't speak of everybody else, but I assume that everybody else feels the same way, but I think it is because we have good relationships with our colleagues and you know even to the point that we socialize out of work, we are making an effort to have team days out, evenings out, because it kind of boosts morale and if morale is high and we are starting well with each other then work is easier, I think. The patients are aware, they pick up of the fact that everyone is happier, the relatives can see that everybody has a good relationship and things run smoothly.



